SCIENTIFIC AMERICAN

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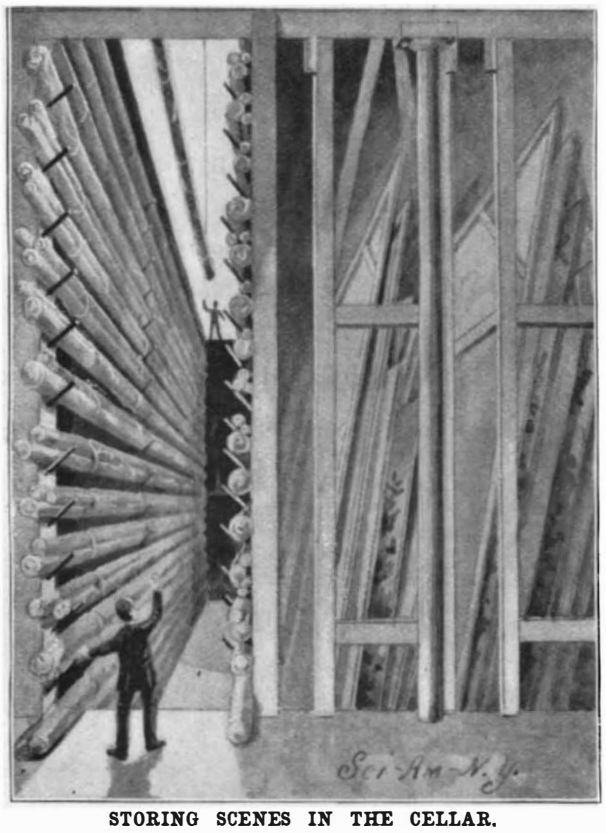

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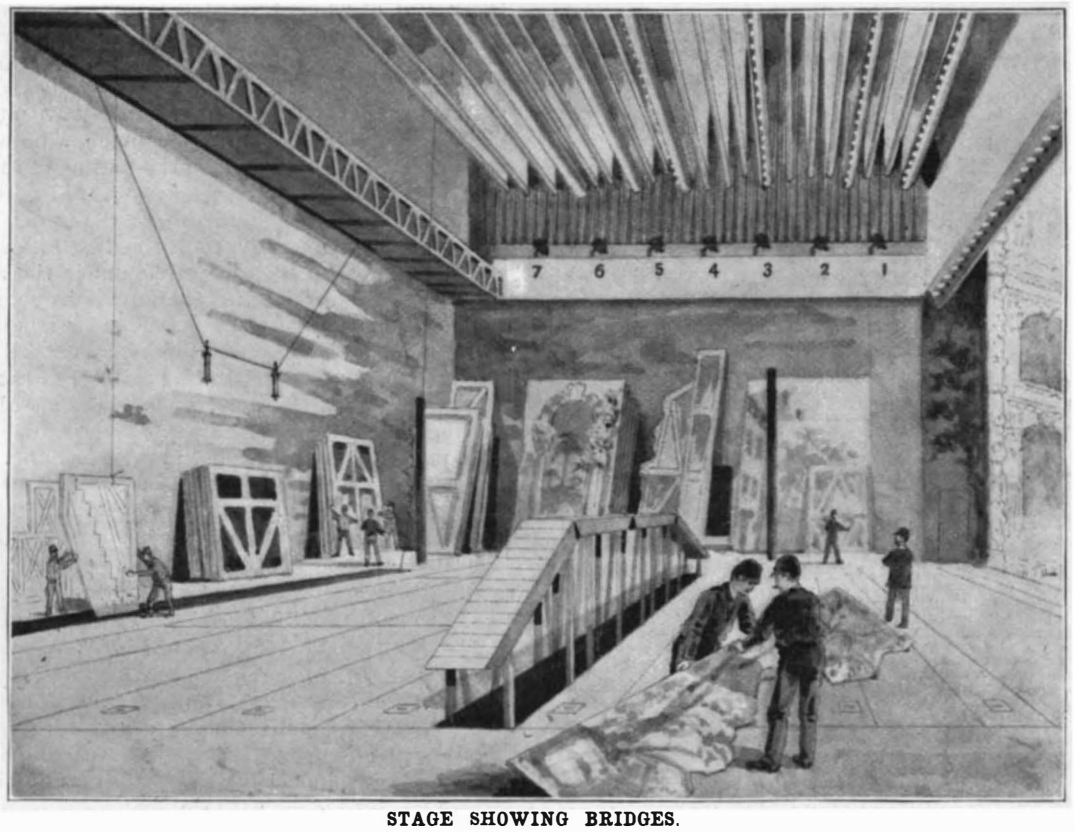

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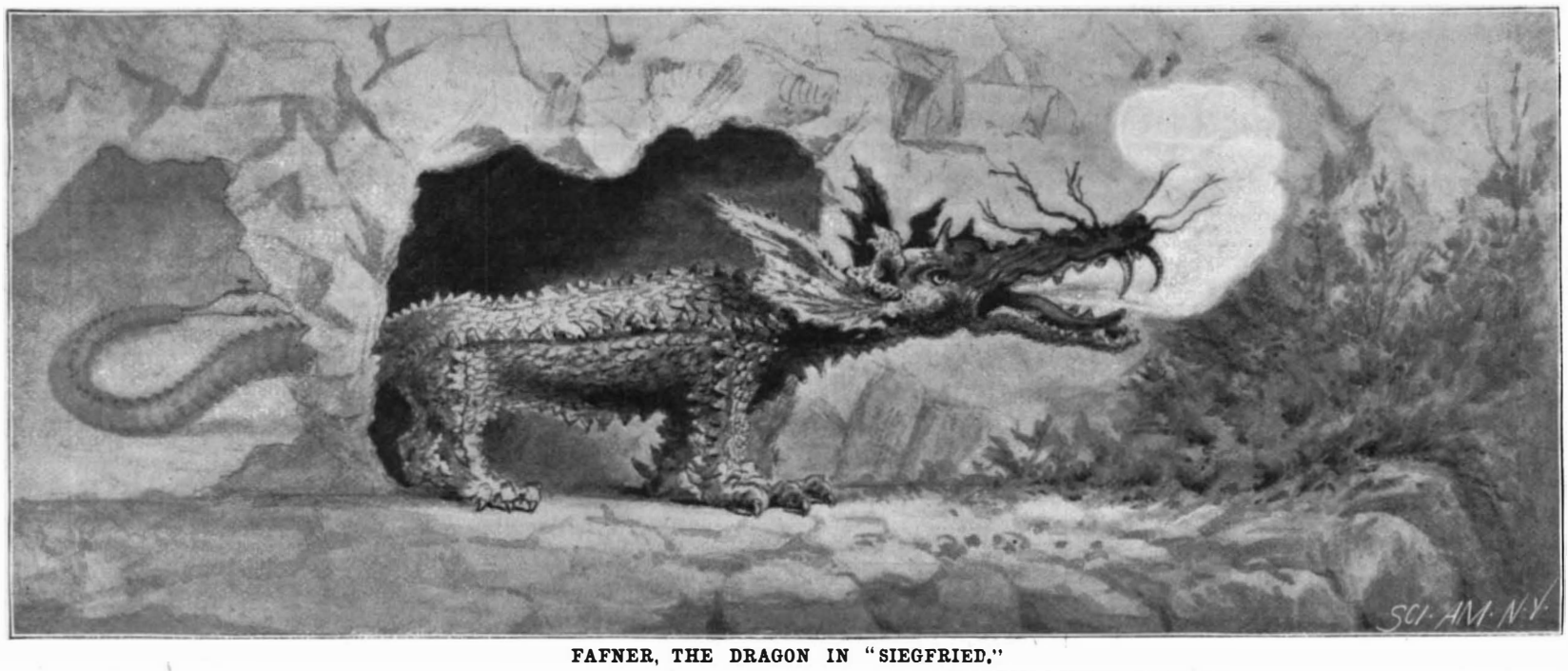

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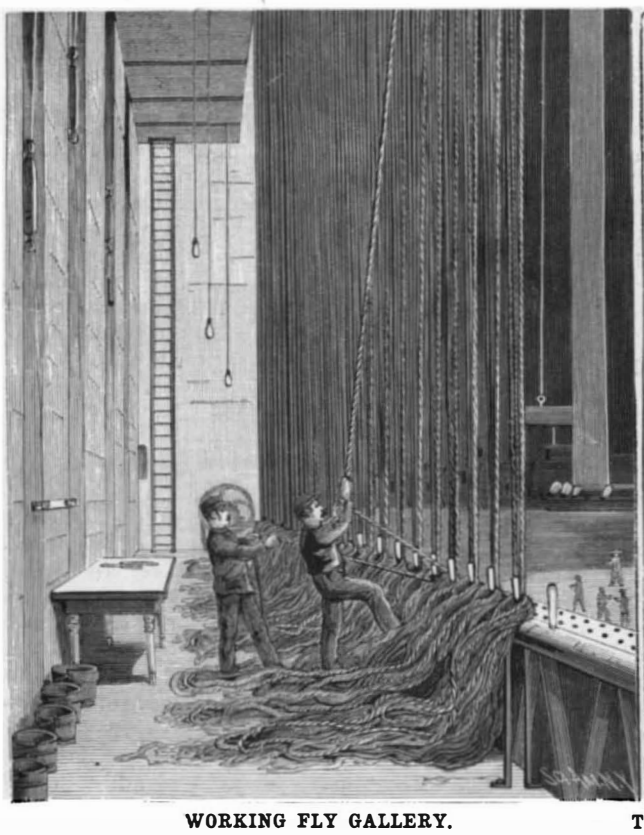

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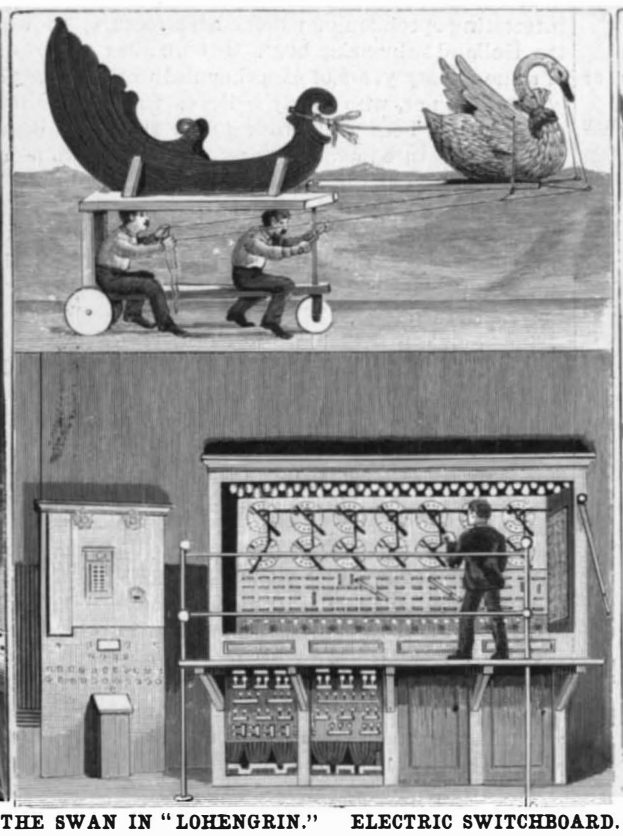

THE SWAN IN "LOHENGRIN." ELECTRIC SWITCHBOARD.

PAINTING SCENERY FROM THE PAINT BRIDGE.

BEHIND THE SCENES AT THE GRAND OPERA.—[See page 346.]

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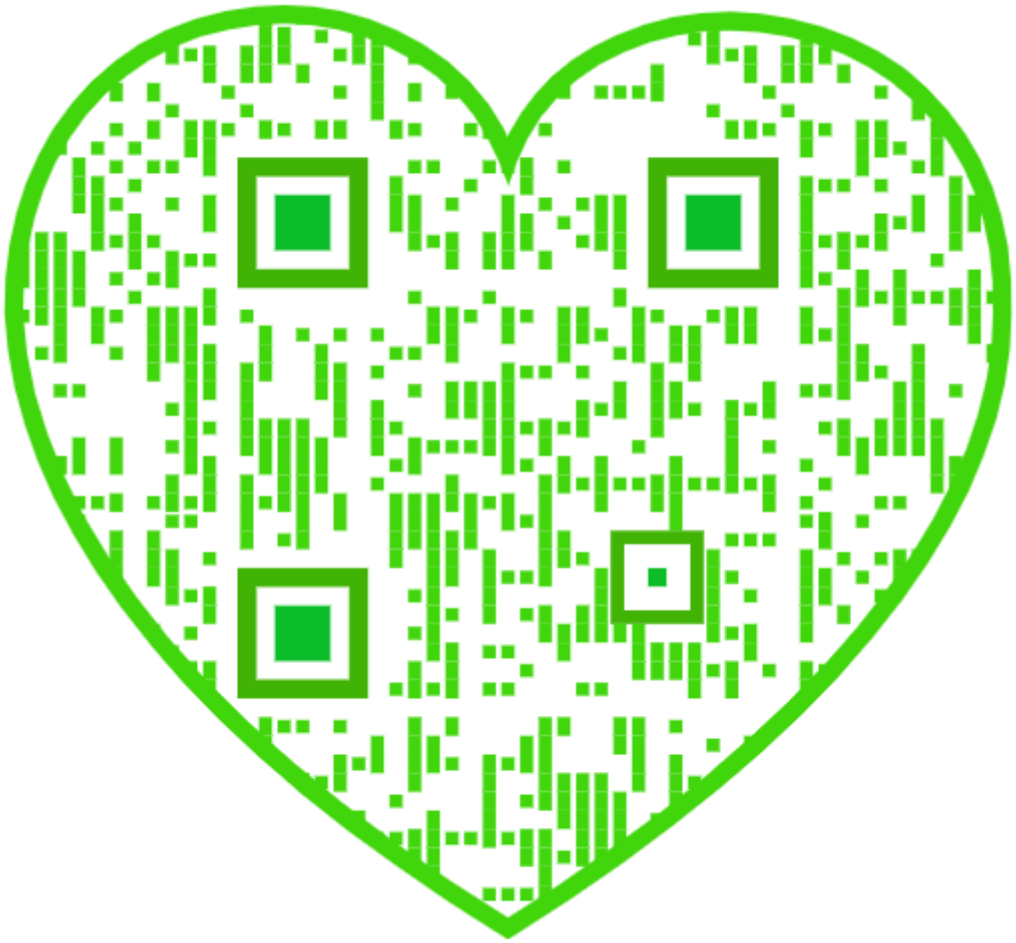

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Contents.

(Illustrated articles are marked with an asterisk.)

Accident, third rail route..... 343
Americans who toil..... 342
Bedrooms, the air of..... 342
Books, new..... 348
Boston subway, the..... 340
Debts, national..... 343
Dock front railway, New York.. 338
Dragon, the, in Siegfried*..... 337
Dry dock leak, Brooklyn Navy Yard*..... 342
Electrical engineers, American 339
Electric lamp, mast arm*..... 341
Feeding, Sunday..... 339
Fires, electrical, causes..... 346
Forge, Siegfried's..... 347
Fruit, the uses of..... 342
Grand opera, production of*..... 337
Greeley, Judge, Assistant Commissioner of Patents..... 339
Heavens, the, for June..... 339
Horse, spoiling a..... 341
Inventions recently patented.... 348
Iron and steel making, American 338
Library, the Congressional..... 340
Livingstone's African grave..... 342
Locomotive, a costly experimental..... 338
Locomotives, American..... 343
Macaroni industry, the*..... 340
Menthol chlorofor.n for colds.... 344
Metropolitan Opera House stage* 347
Mississippi floods as fertilizers... 338
Notes and queries..... 349
Patent decisions, recent..... 343
Patents granted..... 349
Plants, three curious*..... 344
Rail route, St. Petersburg-Pekin 339
Railway station, Bombay*..... 344
Railway time, fast..... 347
Roofing paint, coal tar..... 343
Science notes..... 343
Scientific books, mailing..... 341
Singing into the tonograph*..... 345
Spaghetti, making*..... 340
Speedway planting spaces, the.. 338
Stage illusions, modern*..... 337
Submarine boat, the Holland... 338
Thatcher, John M..... 339
Theater scenery, working*..... 337
Tone photography*..... 345

TABLE OF CONTENTS OF

Scientific American Supplement

No. 1117.

For the Week Ending May 29, 1897.

Price 10 cents. For sale by all newsdealers.

PAGE

I. ARCHÆOLOGY.—A Mosaic Portrait of Virgil.—A detailed description of a mosaic portrait of Virgil, which has just been discovered in Tunis.—2 illustrations..... 17860
Primitive Man in Egypt.—A Review of M. De Morgan's new work on the age of stone and of metals..... 17860

II. COSTUMES.—The Centennial Jubilee of the High Hat.—A curious and interesting article, showing the silk hat from 1796 to 1896.—16 illustrations..... 17851

III. ECONOMICS.—Siberia as a Grain Exporting Country..... 17861

IV. ELECTRICITY.—The Berliner Transmitter Patent.—The full text of this most important decision.—The decision of the Supreme Court of the United States.—The first installment of this decision of great interest..... 17852

V. EXPOSITIONS.—The Paris Exposition of 1900.—This article deals with the site of the Exposition, financial arrangements, general regulations, admission of exhibits, catalogues, diplomas, concessions, classifications of exhibits, etc..... 17848

VI. MECHANICAL ENGINEERING.—Centrifugal Pumps for the Union Dry Docks, Newport.—1 illustration..... 17854

VII. MISCELLANEOUS.—Finger Prints in the Determination of Identity.—3 illustrations..... 17859
The Burning of the French Charity Bazar.—1 illustration..... 17850
The European Concert.—A description of the so-called "concert of Europe," with illustrations of the rulers of the countries concerned.—8 illustrations..... 17847
Engineering Notes..... 17857
Electrical Notes..... 17857
Miscellaneous Notes..... 17857
Selected Formulæ..... 17856

VIII. NATURAL HISTORY.—A Bear Family.—1 illustration..... 17858
Reptiles of the Desert..... 17858

IX. PHOTO-ENGRAVING.—Colloid Reliefs.—Making and direct printing from colloid surfaces.—By THOMAS BOLAS..... 17855

X. PHYSICS.—A New Test for Oil Paintings.—A curious use to which the Roentgen rays are put..... 17856

XI. SOUND.—The Dussaud Microphonograph.—A full description of a new instrument which enables deaf mutes to perceive sounds.—3 illustrations..... 17861

XII. TECHNOLOGY.—Aspirators and Separators for the Disposal of Shavings.—This article describes an interesting system for the disposal of shavings in a large woodworking shop.—2 illustrations. 17855

THE PLANTING SPACES ON THE HARLEM SPEEDWAY.

We are informed by the Park Commissioners that steps are being taken to remedy the defects in the tree-planting trenches which have been built on each side of the Harlem Speedway, New York. By reference to our issues of February 6 and 13 it will be seen that these trenches consist of an inner stone wall, three feet high, adjoining the roadway, an outer wall five feet high, and a bottom of eight inches of concrete, except where the fill is of earth, when the concrete is omitted. We pointed out at the time that the construction of these masonry and concrete trenches was likely to defeat the very end at which they aimed, since they would prevent the spread of the roots, and would also retain the surface water that found its way to the bottom of the trench.

We are informed by Commissioner W. A. Stiles that the alterations which are to be made will be directed to securing drainage through the bottom of the trenches; the provision for securing two feet of good soil between the surface and the top of the trench wall and extending continuously from the tree line under the roadway, and, where practicable, under the sidewalk, and the perforation of the wall at various points where it is in course of construction. There is no doubt that these changes, if they are thoroughly carried out, will go far to remedy the harmful features of the work as mentioned above, and every one who has the beautifying of the city at heart will be relieved to learn that the matter has at last been taken in hand. At the same time no satisfactory reason has ever been given for the construction of this work, and we cannot but feel that it is due to the citizens of New York that some explanation should be forthcoming.

A NEW LOCOMOTIVE FOR THE PURDUE UNIVERSITY TESTING LABORATORY.

Our readers in general, and particularly those among them who are engaged in railroad work, will be interested to learn that the Schenectady Locomotive Works are building a second locomotive for use in the testing plant of Purdue University. The valuable work which has been done with the first locomotive during the past five years has been recorded from time to time in the railroad and technical papers, and the results have proved of great assistance both to the designer and the locomotive superintendent. The engine that was ordered in 1891 was fairly representative of the standard locomotive of ten years ago; but, in order to keep thoroughly abreast of developments, the authorities of Purdue decided to have built a more modern machine which should embody the latest ideas and practice. To this end the new locomotive will be built to carry a pressure of 250 pounds to the square inch in the boiler, and the cylinders will be detachable. Various diameters of the latter will be provided, so that the best ratio of cylinders to boiler can be determined. Bushings will also be provided for the low pressure cylinder, by means of which experiments may be made to determine the best ratio of high to low pressure cylinder. It will be possible to determine on the new locomotive the vexed question of the relative economy of the simple and compound types—a question which, judging from the contradictory reports from the various railroads, is very much in the air at the present writing.

THE LAUNCHING OF THE HOLLAND SUBMARINE BOAT.

On Monday, May 17, there was launched at the Crescent Shipyard, Elizabethport, N. J., an extremely interesting specimen of marine architecture, known as the Holland submarine boat. It embodies the results of some twenty years of experimental work on the part of the designer, who firmly believes that the submarine torpedo boat will prove to be the most deadly weapon of future naval warfare. The Holland, as she is called, is the first of her type ever built and launched. The government is at present building another and larger boat of the kind at Baltimore, and it was the long delay in completing the latter vessel that caused a private company to commence the construction of the Holland. The government vessel was described and illustrated in the SCIENTIFIC AMERICAN of April 25, 1896. She is 80 feet long, 11 feet in diameter, and is to be able to launch five torpedoes from a tube in her bow. The Holland is a much smaller boat, being only 55 feet long and 11 feet in diameter. She is to have a speed of 15 knots an hour when at the surface, and of from 8 to 10 knots when submerged. At the surface she will be run by a gas engine, and when submerged power will be furnished by electric storage batteries. With tanks filled and all the crew aboard there will be a reserve buoyancy of 600 pounds, and she is caused to sink by altering the pitch of the diving rudders, the forward motion of the boat and the downward pitch of the rudders combining to force her below the surface. The boat is maintained at the required depth by means of delicate automatic mechanism, similar to that used in the automobile torpedo.

The armament is extremely powerful, consisting of three 18 inch Whitehead torpedoes which are discharged through the bow, and also an aerial gun at the bow and a submarine gun at the stern. The former will throw a 100 pound dynamite shell a distance of one mile and the submarine gun will send its shells some 650 feet through the water. In attacking a ship the Holland would discharge her aerial gun when she was well within range and then, sinking beneath the shelter of the water, she would run up within say 1,000 yards of the enemy. Here she would rise to locate the target, and sinking again she would discharge her torpedoes, and passing under the ship, if this should prove to be necessary, she would discharge her rear gun to complete the work of destruction. The tests of the Holland will be commenced in a few days, and they will be watched with the keenest interest by the whole naval world. It is in this direction that the development of torpedo warfare promises the most effective results. The secrecy of submarine attack, the impossibility of locating the boat, and the swift and complete destruction it is capable of working, will undoubtedly render a successful submarine boat the most powerful and most dreaded weapon of the age. For the defense of our rivers and harbors it would be of incalculable value.

IMPROVED TRANSPORTATION FACILITIES ON THE DOCK FRONT, NEW YORK CITY.

West Street, on the Hudson River front, and South Street, on the East River front of New York, are heavily encumbered with a miscellaneous traffic which is chiefly composed of heavy drays and trucks, surface cars and ferry passengers. The former are continually coming and going between the freight houses and ferries and the business portions of the city, and thickly intermingled with these are the vast crowds that come and go to and from Jersey City and Long Island. The Board of Consulting Engineers of the Dock Department has reported in favor of improving the handling of freight and relieving the general congestion by building a four-track freight railroad along the dock front from Battery Place to Christopher Street on the North River and from the Battery to Corlears Hook on the East River. It is proposed to run the present surface tracks of the street railways on an elevated structure, and overhead bridges are to be provided at the cross streets for foot passengers. The plan seems to be well adapted to meet the necessities of the case. At present the only standard freight tracks in the lower part of the city are those of the New York Central Railroad which run through Hudson Street to the freight depot at Beach Street. The proposed four-track road will be provided with spurs running to the various freight sheds and landing stages, and the freight which is brought across the river in cars will be handled on the New York side with less labor and greater dispatch than under the present system.

THE IRON AND STEEL INSTITUTE ON AMERICAN COMPETITION.

We recently drew attention to the fact that our manufacturers have taken the leading position in the wire industry of the world. The success which we have achieved in this branch is only one feature of our general supremacy in the manufacture of iron and steel. At the recent annual meeting of the Iron and Steel Institute of Great Britain, a leading feature of the discussion was the increasing success of American competition. President Pritchard Martin, in the course of his address, referred to the enormous output of the leading American steel works. He pointed out that the Americans were far in advance of English engineers and builders in the uses to which steel was applied, and the point was illustrated by reference to the steel frame buildings which are rapidly springing up in all the great cities of the United States. He urged the necessity for lower freight rates, and claimed that the British industry was severely handicapped by the high cost of transportation. In this respect, the American and German manufacturers were favored by rates that are considerably less than those in England. This statement on the part of the president will explain in some measure the exceedingly prosperous condition of the English railroads as compared with our own. In the six months ending December, 1896, the leading English companies raised their rates of dividend by amounts varying from ⅝ to 1⅝ per cent, some of them paying as much as 6⅝ and 7⅛ per cent to the shareholders at the close of last year.

THE MISSISSIPPI FLOODS AS FERTILIZERS OF THE SOIL.

We have more than once been asked by correspondents whether it is not a mistaken policy on the part of the government to attempt to keep the Mississippi within its banks, and whether it would not be better to allow the waters to overflow and deposit each spring a fresh layer of rich soil upon the land. Attention is drawn to the annual overflow of the Nile, upon the regular occurrence of which the people of the Nile valley depend for their crops. In reply it may be said that no just comparison can be drawn between the two rivers. The rise of the Nile is gradual and it rarely overflows its banks in the cultivated districts with any

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destructive effect upon the surrounding country. The water is drawn off by artificial canals and spreads quietly over the adjacent country. The Mississippi on the other hand works far more harm in many of the inundated districts than any richness it may impart to the soil can compensate. If the velocity of the overflow waters exceeds a certain rate, it begins to exercise a loosening and cutting effect upon the soil, carrying away the rich loam and laying bare the coarser gravel and rocks. Moreover, the seasons are too brief to permit the bottom lands of the Mississippi to lie so long under water. By the time the waters have receded, and the lakes and large pools left in the hollows have dried up, the season is too far advanced for the crops to be put in to good advantage. The equable climate of the Nile valley, on the other hand, presents no difficulties due to the shortness of the seasons.

THE HEAVENS FOR JUNE.

BY WILLIAM R. BROOKS, M.A., F.R.A.S.

THE SUN.

The sun's right ascension on the first of the month is 4 h. 39 m. 25 s.; and its declination north 22 deg. 9 m. 43 s.

On the last day of the month its right ascension is 6 h. 39 m. 34 s.; and its declination north 23 deg. 8 m. 31 s.

On the twentieth day of June the sun reaches its greatest northern declination, 23 deg. 27 m. 12 s., and entering Cancer, summer commences.

MERCURY.

Mercury is morning star. On June 2 it is stationary. On June 15 Mercury reaches its greatest elongation west of the sun, 23 deg. 4 m., and this will be the most favorable time to see Mercury, either with the naked eye or telescope, as morning star. On the same date that this planet reaches its greatest elongation from the sun, but five hours later, it is at its greatest heliocentric latitude south. On June 28, at 7 h. 26 m., Mercury is in conjunction with the moon, when Mercury will be 5 deg. 11 m. south of the moon. On June 29 Mercury is in conjunction with Neptune, when Mercury will be only 14 minutes of arc south of Neptune, or less than half the apparent diameter of the moon.

The right ascension of Mercury on the first of the month is 3 h. 38 m. 0 s.; and its declination north 15 deg. 29 m. 18 s. On the last day of the month its right ascension is 5 h. 34 m. 57 s.; and its declination north 22 deg. 37 m. 24 s.

VENUS.

Venus is now morning star and is at its greatest brilliancy on June 3. Throughout the month it will be found to be the same gorgeous object as morning star that it was for so many weeks as evening star.

Venus will be so bright during June as to be easily seen with the naked eye in the daytime if its position be even approximately ascertained. On June 15 Venus will be on the meridian or due south at 9 o'clock A. M. at an altitude of 12 deg. 38 m. above the celestial equator. This, for the latitude of the middle States, would be from 12 deg. to 15 deg. above the half way point from the horizon to the zenith. These directions will apply with sufficient accuracy for several days before and after the above named date.

On June 25, at 3 h., Venus is in aphelion, or in that part of its orbit farthest removed from the sun. On June 26, at 1 h. 4 m., Venus is in conjunction with the moon, when the planet will be 8 deg. 38 m. south of the moon.

On the first of the month Venus rises at 2 h. 47 m. A. M., and crosses the meridian at 9 h. 25 m. A. M. On the last day of the month Venus rises at 2 o'clock A.M. and crosses the meridian at 8 h. 52 m. A. M.

The right ascension of Venus on the fifteenth day of the month is 2 h. 42 m. 18 s.; and its declination north 12 deg. 37 m. 53 s.

MARS.

Mars is evening star, and in the constellation Cancer, about half way up the western sky at dusk. Its orbital motion is plainly marked from night to night, with reference to the two bright stars Castor and Pollux in Gemini, and the little cluster called the Bee Hive, in Cancer, toward which Mars is now moving.

On June 5, at 6 h. 10 m., Mars is in conjunction with the moon, when Mars will be 1 deg. 49 m. north of the moon.

On June 1 Mars crosses the meridian at 4 P. M., and sets at 11 h. 15 m. P. M. On June 30 Mars crosses the meridian at 3 h. 15 m. P. M., and sets at 10 h. 5 m. P. M.

The right ascension of Mars on June 15 is 10 h. 20 m. 36 s.; and its declination north 11 deg. 45 m. 48 s.

JUPITER.

Jupiter is evening star, and in excellent position for telescopic scrutiny in the early evening hours. After remaining apparently stationary for several days within two degrees to the eastward of Regulus, Jupiter is now moving slowly away from the star and toward the east, thus affording another interesting illustration of a planet's orbital motion among the stars.

The following are some of the interesting phenomena of Jupiter's satellites:

On June 5, at 8 h. 16 m., the shadow of satellite I will enter upon the disk. At 9 h. 4 m. satellite IV will disappear in occultation. At 9 h. 20 m. satellite I will leave the disk of the planet, and at 10 h. 35 m. the egress of the shadow of satellite I will follow.

On June 12, at 8 h. 58 m., satellite I will enter in transit; and at 10 h. 11 m. the shadow of satellite I will enter in transit.

On June 19, at 8 h. 0 m., satellite II will pass off the disk; and at 10 h. 15 m. the shadow of satellite II will leave the disk.

On June 26, at 7 h. 52 m., satellite II will enter upon the disk in transit; and at 10 h. 14 m. the ingress of the shadow of satellite II will occur.

On June 7, at 1 h. 30 m., Jupiter will be in conjunction with the moon, when the planet will be 3 deg. 43 m. north of the moon.

On the first of the month Jupiter crosses the meridian at 5 h. 35 m. P. M., and sets at 20 m. after midnight.

On the last of the month Jupiter crosses the meridian at 3 h. 55 m., and sets at 10 h. 30 m. P. M.

The right ascension of Jupiter on June 15 is 10 h. 24 m. 19 s.; and its declination north 11 deg. 10 m. 58 s.

SATURN.

Saturn is in the southeastern evening sky, and good telescopic observations may be made after 9 o'clock, although its southern declination is an unfavorable feature.

On the first of the month Saturn is on the meridian at 10 h. 55 m. P. M., and this would be the best hour to observe this interesting planet.

On June 12, at 9 h. 31 m., Saturn is in conjunction with the moon, when the planet will be 7 deg. 15 m. north of the moon. The right ascension of Saturn on the fifteenth of the month is 15 h. 34 m. 43 s., and its declination south 16 deg. 58 m. 38 s.

URANUS AND NEPTUNE.

Uranus is also in the southeastern evening sky just below Saturn. On June 18, at 8 P. M., Saturn and Uranus are in conjunction, when Uranus will be 2 deg. 3 m. south of Saturn, a most favorable opportunity to identify this far-away world.

Neptune comes into conjunction with the sun on June 10 and hence is invisible.

Smith Observatory, Geneva, N. Y.

JOHN M. THATCHER.

Ex-Commissioner of Patents John M. Thatcher died recently at Proctor, Vt. He was born at Barre, Vt., in 1836, and received a common school education, and finally graduated at the University of Vermont. He fought in the civil war. After being mustered out of service he engaged in teaching. He received an appointment as a clerk in the Patent Office in 1864 and was assigned to duty in the examining corps. He seemed exactly suited to the business, and in less than twelve years he was at the head of the Patent Office as Commissioner, passing through each one of the intermediate grades in turn. During this time he studied law and was admitted to the bar in 1870. In 1875 he resigned the office of Commissioner and became the law partner of L. L. Coburn. Mr. Thatcher was, with one exception, the only person who ever rose from the grade of clerk in the Patent Office to that of Commissioner. As Commissioner his decisions evinced the most painstaking and thorough study of the cases.

In 1871 he was appointed a member of the Civil Service Sub-Commission of the Interior Department. He exercised a controlling influence in carrying into effect reforms in the appointments and promotions in the executive departments in Washington. He was an excellent illustration of the possibility open to the youth of America who is possessed with an indomitable will, patience and intellectual ability.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

The annual business meeting of the Institute was held on May 18, at 12 West Thirty-first Street, New York City, and was called to order by President Duncan at 4 P. M. The counting of the ballots by Mr. Hamilton and Dr. Pupin, who were appointed tellers, resulted in the announcement of the election of the council ticket as follows:

For President, Dr. Francis B. Crocker, of New York City; for Vice Presidents, Dr. A. E. Kennelly, of Philadelphia, Pa., Mr. Chas. S. Bradley, of New York City, Prof. Dugald C. Jackson, of Madison, Wis.

The announcement by the tellers of the election of Dr. Crocker was greeted with hearty applause, and the President-elect was escorted to the chair and briefly acknowledged his appreciation of the honor bestowed upon him.

The report of the committee on a new design for the Institute badge, which had been referred to this meeting by the Executive Committee, was taken up and thoroughly discussed, resulting finally in the adoption of the new design recommended by the committee. Arrangements for the withdrawal of the old design and substitution of the new one will be made at an early date.

The paper on "The Synchronograph," presented April 21 by Dr. Crehore and Lieut. Squier, was then taken up for discussion. Mr. F. W. Jones opened the discussion, which was participated in by Dr. Kennelly and Mr. Delany. A paper on "The Application of Hyperbolic Analysis to the Discharge of a Condenser" was presented by Dr. Macfarlane. Owing to lack of time, discussion was postponed until the general meeting, July 26.

A 7 P. M. the meeting adjourned and the members reassembled at the "Arena," 41 West Thirty-first Street, where arrangements had been made for the annual dinner under the direction of Mr. Herbert Laws Webb, chairman of the Committee on Papers and Meetings, and Mr. T. C. Martin. Although a sudden increase of about fifty per cent in the number of guests necessitated the laying of ninety-three covers, the overflow was provided for, and the event passed off pleasantly under the skillful guidance of Toastmaster Martin. Toasts were responded to by Dr. F. B. Crocker, Mr. F. W. Jones, Dr. M. I. Pupin, Dr. C. E. Emery. Dr A. E. Kennelly, Mr. Ralph W. Pope, Mr. J. W. Lieb, Jr., Mr. Herbert Laws Webb, Mr. Nelson W. Perry and Mr. Joseph Sachs.

The exercises were interspersed with instrumental and vocal music by Mr. George Hali Guy and Mr. Charles McL. Paine. Mr. Guy played a waltz of his own composition, which he dedicated to the American Institute of Electrical Engineers.

SUNDAY FEEDING.

Under the heading of the "Sunday Penalty of Irregular Feeding" the Medical Record points out that in our progress from barbarism we have evolved a people with whom regularity in eating is absolutely necessary to good health. As a result of this artificial existence, the secretions are poured out and ready for action with the monotony of clockwork. If this custom is neglected, the violator not only suffers bodily discomfort, but an actual injury is done to the digestive apparatus, which has been so educated that it requires a definite amount of exercise and positive promptness in feeding that requirement. The stomach having poured out its secretions, as customary, waits only a short time before allowing them to be absorbed without the accompanying nutrition which goes to the formation of more secretions. After a few such experiences, the secretions become less in amount and activity, and indigestion ensues. Dyspeptics are ordered to eat at inflexibly regular intervals. Normal stomachs are by no means many, yet this rule, so imperative to sufferers, is regularly disregarded by the well. Once a week, the three regular daily meals are replaced by late rising and abstinence, followed by gluttony. The gastric juices know nothing of a seventh day of "rest," and the result is discomfort, stupidity and loss of appetite on Monday.

ST. PETERSBURG-PEKIN RAIL ROUTE.

The British Trade Journal says: "Speculations are being made as to the effect of railway communication between St. Petersburg and Pekin. It is pointed out that when such a line of railway is in working order St. Petersburg would be only five days and London only eight days from the Chinese capital. It is asked, what would be the effect upon British trade with China? That all depends upon the cost of sea as compared with railway carriage. Estimating the railway rates at the low average of seven miles for 1d., which prevails to a large extent in the United States, the cost of sending goods from St. Petersburg to Pekin at the same rate would mean a total charge of about 50s. per ton—a figure which does not compare favorably with the present rates of transport by sea, so that the Russo-Chinese line would not have much effect upon the trade between British ports and Hong-Kong. Yet if Russia develops her manufacturing enterprises, it would ultimately lead to severe competition. In the event of such a Russian state line carrying goods to China at a nominal rate, we would find our trade with Chinese ports being affected in the same way by low railway rates as our trade with southeastern Europe, where the Germans and Austrians are able to send goods very cheaply compared with the cost of sea carriage from London."

JUDGE GREELEY, ASSISTANT COMMISSIONER OF PATENTS.

We are pleased to note that Judge Greeley, heretofore one of the Examiners in Chief at the United States Patent Office, in Washington, has been made Assistant Commissioner of Patents, Examiner Steward succeeding Judge Greeley in the Board of Examiners. It will be remembered that Judge Greeley was one of the judges to pass on the SCIENTIFIC AMERICAN prize essay contest, for our fiftieth anniversary number, last year. Judge Greeley is a graduate of Dartmouth College, and a lawyer by profession. He entered the Patent Office as a fourth assistant examiner in 1884. He has served in the practical work of the office in many divisions, and has had under his own personal consideration and examination nearly every important art represented in the Patent Office. The promotion is eminently proper and well deserved.

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The Congressional Library.

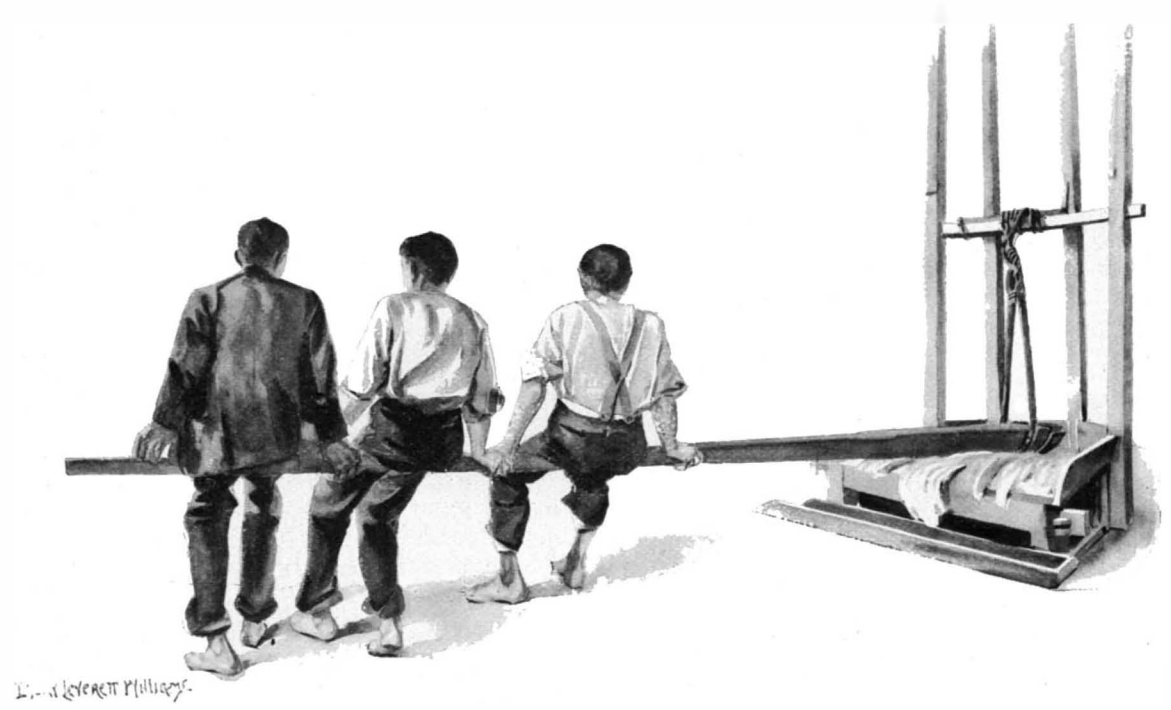
The National Congressional Library was established in 1800, but during the war with England was destroyed, together with the capitol, in 1814. Many documents destroyed then it has been impossible to replace. Part of them, however, were duplicated in the library of Thomas Jefferson, which was purchased by Congress, and consisted of 7,000 volumes. The library had grown to 55,000 volumes in 1851, when by an accidental fire it was reduced to 20,000 volumes. The next year Congress appropriated $75,000 to replenish it. Since that time it has grown steadily. The library proper occupies the entire western projection of the capitol building. The new and recently built separate structure will afford room for the natural expansion and give more opportunity for classification and arrangement. The growth of the library has been due in part to the liberal Congressional appropriations, averaging in the last ten years $11,000 per annum, but more to the results of the Copyright Act and the consolidation with the library of the Smithsonian Institution. The largest private donation to the National Library has been that of Dr. Joseph M. Toner, of Washington, who, in 1882, presented his private library of over 27,000 volumes. According to the regulations of the copyright laws, each work copyrighted in the United States must be deposited in the Library. This part of the law went into effect in 1870, when the Patent Office library was deposited in the National Library, says Self-Culture. The National Library is distinct from the libraries of the Senate and House of Representatives.

The Completion of the Boston Subway.

The first trolley car ran through the completed part of the Subway on May 15 to test the roadbed and the rails. The trip was uneventful, everything being in excellent working order. A force of over 200 men is now employed in laying tracks and making electrical connections. It is expected that Sections 1 and 2 will be open for public travel Bunker Hill Day, June 17.

MAKING SPAGHETTI.

Every country and nation has certain prepared foods that are distinctly peculiar to that place or people. These are often the standard articles of nourishment, and frequently combine the elements of nutrition with inexpensiveness, so that they serve as general and perhaps entire sustenance, especially among the poorer classes.



MANUFACTURE OF SPAGHETTI—KNEADING THE DOUGH.

Making spaghetti or macaroni is an especially Italian industry; and this food is consumed by that nation in such quantities as to easily class it as their standard edible. It is also eaten largely by other than Italians, and is made in different ways by Americans and other manufacturers. It is commonly used in much of the modern cookery.

As a nutritive element, it is most wholesome and simple, some particular kinds having more nourishing ingredients than others. The American product sometimes contains albuminous matters as well as the common wheat flour, and is known as egg macaroni, etc.

But the Italian make is composed of only coarse wheat flour and water stirred thoroughly together. Sometimes different grades of wheat flour are used, either coarser or finer, but this depends wholly upon the manufacturer and the particular form to be made.

Macaroni is easily prepared for cooking, though different methods are employed to cook and serve it. Perhaps it may be accredited the Italians that their mode is the one to secure an epicure's approbation, but most of the many preparations furnish relishable food.

The names spaghetti, macaroni, mezzani, etc., are but terms for the different sizes and forms that this substance is made into by machinery.

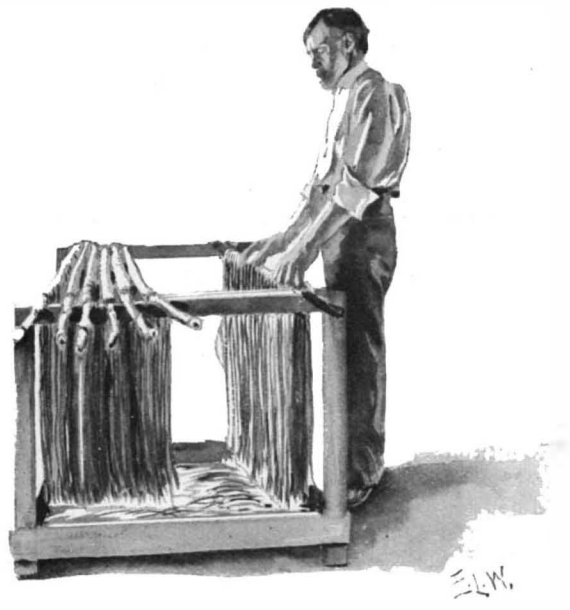
Macaroni is the common pipe stem sized preparation, and is most extensively used. Spaghetti is finer and solid, about the size of an ordinary string. Whether its small size gives it any advantage in eating qualities over the coarser macaroni is a matter of personal opinion. Other varieties are cut in small bits about a half inch long for soups, stews, etc., and some various lengths, fluted lengthwise and quite curly.

As an article of commerce it has a considerable importance, being sent from the manufactories in America to many other countries, as well as supplying the consumers in this country.

A large supply of Italian spaghetti and macaroni in America is made in Boston. The manufactory is located in the Italian quarter of that city. It is a three-storied wooden structure, each story being utilized for different processes in the manufacture. The lower floor has all the machinery that moulds into form the raw masses of dough, while the two upper floors are devoted to drying, packing and assorting. A large wooden trough, capable of holding a great quantity of flour, is in a small ante-room.

The flour is poured into this trough, in as large a quantity as is desired for one batch of dough. This is mixed thoroughly with water, and stirred about by a man, who uses a wooden paddle, or, if necessary, he is not over-scrupulous about the use of his hands as mixing implements. The flour and water is stirred about until the whole mass becomes a batch of heavy, tough dough, and cannot be longer stirred by the hands. This mass is then separated into several pieces and taken to a low, wooden, table-like stand, upon which it is spread. Suspended over this stand is a great wooden beam, hinged and pivoted at one end by fitting into a cup-like iron socket, and hung partly by a stout rope.

The other end extends over the table, quite a distance (about 10 feet), and is rounded and tapers somewhat. The part of the beam that is immediately over the table is wedge-shaped on its under side. When not in use it is hung out of reach, so as not to interfere with the workmen; but when the dough is placed upon the stand, it is taken down and extends over the mass. Three and often four men seat themselves upon the rounded end, and by concerted signal commence to hop, carrying with them at each spring the beam upon which they are seated. This they continue, not ceasing until they describe a semicircle, the beam swinging on its pivot and the wedge-shaped part coming down upon the dough repeatedly, denting it in long narrow strips. Backward and forward these fellows hop with the beam,



PREPARING FOR DRYING.

until at last the dough is chopped into an elastic consistency, that is desired for its further use. This is the only effectual way of kneading dough when in such a mass. When it is at length well kneaded, the beam is suspended out of reach, and one of the men cuts the lump into blocks about 14 inches square, with a large knife. This is then taken to a great machine, which converts it into the desired form, either macaroni or spaghetti. This machine has a large upright cylinder, and into this is forced a great steel plunger, which fits very snugly, pressing whatever may be in the cylinder into a most compact mass.

The dough is placed into this cylinder, and packed as solidly as possible, when the machinery is set in motion, and slowly the plunger forces its way by means of a powerful screw down upon the dough.

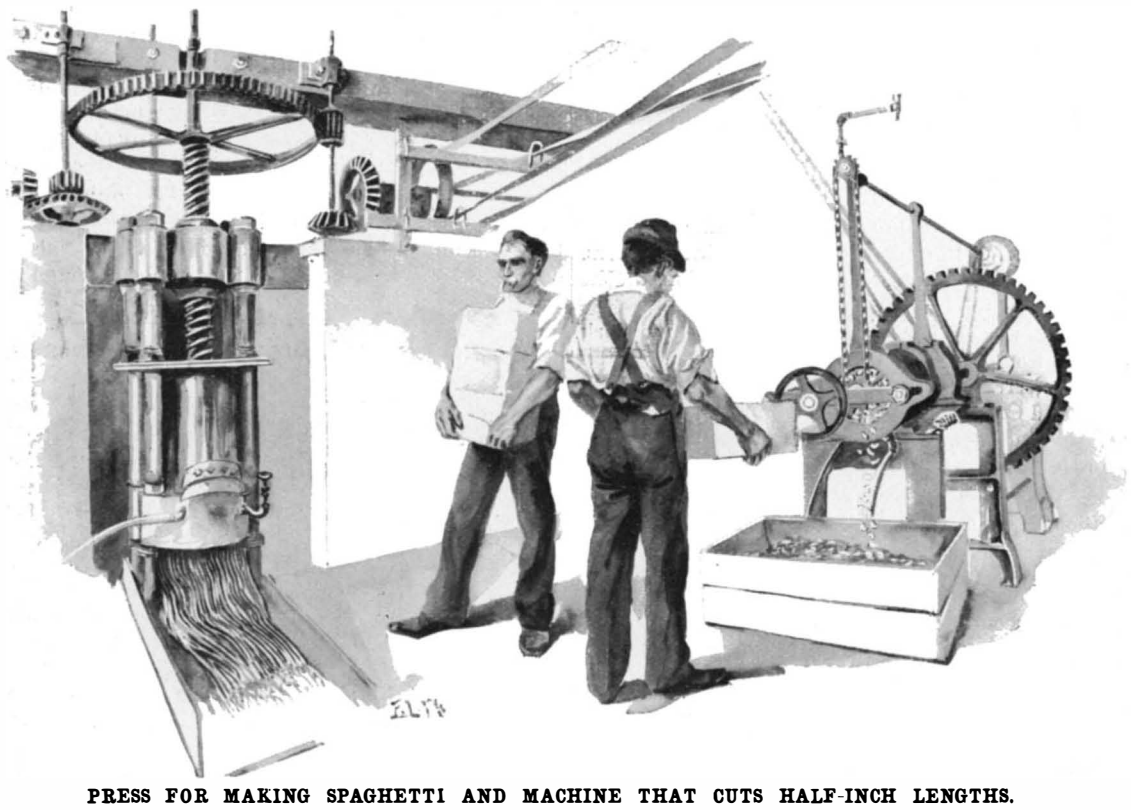
The bottom of the cylinder has a metal plate, perforated and furnished with mandrels.

As the dough is pressed ever tighter it finally escapes through the perforations in the form of macaroni or spaghetti. The dough, being moist and tough, does not break as it comes out, and when a quantity is in the receiving trough, it is cut off by a workman with a large knife and carried to a framework over which lie bamboo rods, upon which it is hung. The workman separates piece by piece, spreading it the length of the rod, and with large shears cuts it evenly at the ends.

This he continues until the cylinder's contents are exhausted, and then takes the rods of spaghetti and puts them upon racks, at the ceiling of the room, where it hangs until ready to be taken upstairs.

Another machine similar to the first, except that the cylinder is horizontal, prepares the cut pieces of macaroni.

A knife, pressing close to the head of the cylinder,



PRESS FOR MAKING SPAGHETTI AND MACHINE THAT CUTS HALF-INCH LENGTHS.

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revolves by a cogwheel arrangement, cutting the issuing macaroni evenly and uniformly. This drops into a receiving box and is put by a workman upon a cloth stretcher to dry.

When the spaghetti that is hung above is dry enough, it is taken down and carried to the second floor, where another workman takes it off the bamboo rods, and lays it in the same order upon a long cloth bottomed stretcher. This he accomplishes by placing

HUNG ON BAMBOO RODS TO DRY.

the rod of partially dry spaghetti upon the stretcher and then rolling the rod away by pushing at either end.

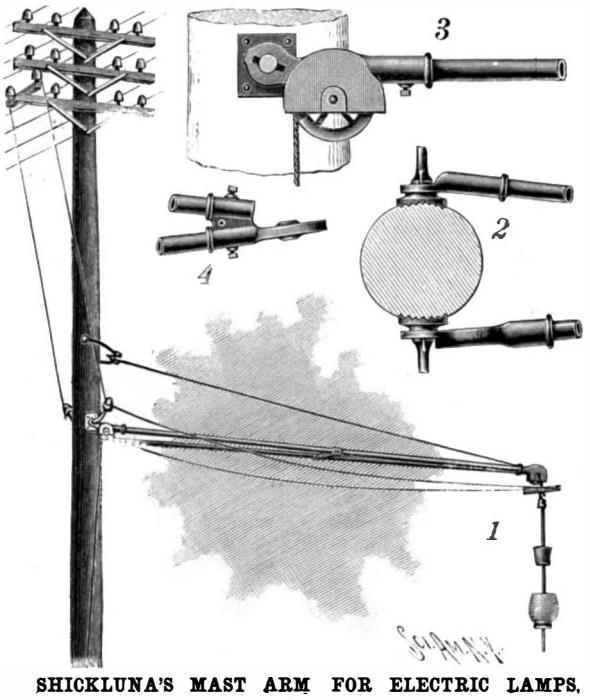
These stretchers are then piled upon racks one over another until ten or more high.

Here they remain until the spaghetti is thoroughly dried, when it is packed in boxes, usually twenty-five pounds per box, and at length is sent to the consumers. The short variety is taken to the next story, where it is spread upon a large canvas and remains until very dry, when it is put into barrels and finally reaches its market.

EMERY LEVERETT WILLIAMS.

A MAST ARM FOR ELECTRIC LAMPS.

The illustration represents a light and strong construction of an overhanging mast arm or bracket from which electric lamps are suspended, one which may be readily applied to a post and adjusted to posts of different sizes. It has been patented by Joseph J. Shickluna, of No. 316 Potomac Avenue, Buffalo, N. Y., and is being introduced in Canada by the Shickluna Mast Arm Company, of Port Colborne, Ont. Fig. 1 represents the application of the improvement, Fig. 2 being a cross section and Fig. 3 a side view of the connection of the inner end of the arm with the post. The arm consists of a pair of forwardly converging members, made of gas pipe or tubing, connected at their front ends by a head, as shown in Fig. 4, the head also comprising a pulley casing in which is an outer guide pulley over which passes the cord from which the lamp is suspended. The side members of the mast arm have at their rear ends eyes or bearings which receive pivot pins formed on base plates secured to the post by screws or otherwise, and in the rear end of one of the members is a pulley casing in which is the inner guide pulley over which the suspension cord passes, the cord passing through the hollow member connecting the two pulley casings and thence to the lamp. The side members of the mast arm, at or near their middle, are connected by a yoke or bridge, made in two sections, adjustable upon each other, whereby the members may be somewhat contracted or spread apart at their inner ends, as may be desirable in connecting the arm to posts of different diameters. Simple means are provided for locking the eyes of the side members removably on their pivots. A supporting wire or cable sustains the mast arm in its horizontal position, the wire extending outward from a yoke on the post above the mast arm to the outer pulley casing. Upon loosening the set screws of the several sockets the parts of the mast arm can be separated and compactly shipped.



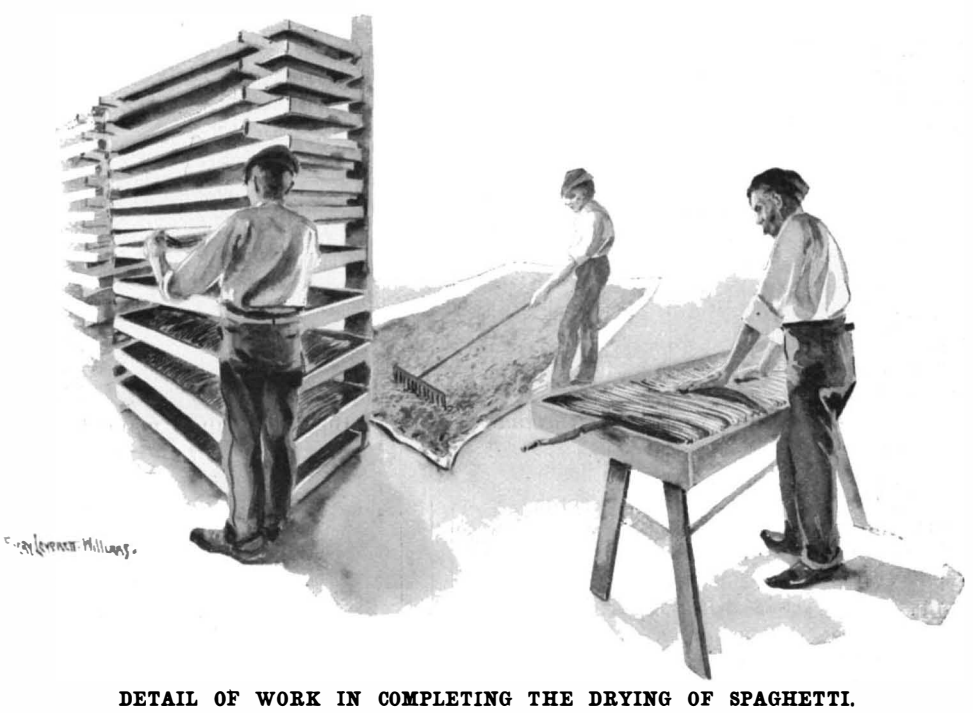
SHICKLUNA'S MAST ARM FOR ELECTRIC LAMPS.

The Spoiling of a Horse!

The following description of the method employed by many persons in handling horses, which we find in the Journal of Medicine and Science, is not simply amusing, but conveys useful suggestions to all who own or have horses to manage, either in the stable or on the road:

Enter the stable with an appearance of great hurry and flurry; rattle open the sliding doors, and, if there are any swinging doors or shutters, throw them back—each with a loud "bang!" This will wake the horse up, and, if he happens to be a nervous animal, will increase the chance of his running away, before the day is over, about fifty per cent.

When you are ready to enter the stall, order the horse, in a loud, rough voice, to "stand over"—at the same time squeeze in and poke your thumb into his ribs. Back him out with great haste and violence, and with such a short turn that he cannot fail to tread on his own feet and back his hips against the side of the stall. Drop the halter and go in search of the harness; if the horse stirs, grab him and yell "Wow!"—the correct stable pronunciation of "Whoa." Adjust the back part of the harness gingerly, so as to give the horse the impression that you are afraid of him; then draw up the saddle girth with all the quickness and vigor you are capable of. If the horse snaps at you for this, throw up your arms and jump at his head or strike him in the face. If he declines to lower his head for the adjustment of the collar, put your arms around his neck and swing downward with your whole weight—perhaps you can weigh it down. Force the bit into his mouth with your thumb, and, standing on tiptoe, struggle with him until you have succeeded in pulling his ears and forelock into place, and put your finger into his eye.



DETAIL OF WORK IN COMPLETING THE DRYING OF SPAGHETTI.

If the horse continues manageable, lead him toward the carriage with the reins trailing on the ground behind him. If there is a door you can leave unfastened, so that it will slap against him as he passes the doorway, do so, and, if he has occasion to step up or down a step, be sure you check him up so that he will perform the feat with a series of plunges and stumbles. Have the shafts propped up, and as you lead the horse under them kick the prop out, thus letting them drop on his back. This will accelerate his motions and teach him to keep an eye on the carriage, which he will henceforth regard as a monster. Run the vehicle down onto him and punch the ends of the shafts into his thighs, or, if you cannot manage to do that, run one of them between his fore legs. Swear, jerk the horse, pull the shafts into place, and adjust the lugs. Keep yelling at the top of your voice, "Wow!" "Back!" "Get over!" etc., to keep the horse awake and show that you are master of the situation. Twist the traces carefully, and leave either one holdback or the shaft girth unfastened. If the driver does not get killed before he has a chance to discover this arrangement, he can get out and alter it.

If you are going to drive, take up the reins and cluck to the horse as soon as you put your foot on the carriage step. If he does not start off at once at a gallop, jerk him and strike him with a whip; but, if he is a good horse and you have followed the foregoing directions carefully, he will probably be only too ready to start. In that case jerk him and yell "Wow!" "Back!"—always say "back" when you say "whoa"—the horse will remember the combination and back somebody off a precipice some day instead of stopping on the brink. Drive him at the top of his speed from start to finish, first on one side of the road, then on the other, jerking and whipping him continually, and yelling from time to time. This will make the horse respect you, excite the admiration of the lower classes, and endear you to the populace generally.

If you have occasion to stop on the street, either do not tie the horse at all or tie him to something he can take with him if he wants to go away. If the weather is chilly, it will toughen him to leave him uncovered; but, should you choose to blanket, throw the blanket over him so loosely that the first breeze will turn it over his head. A cold wind blowing on the chest of a heated horse will refresh him greatly, and if he stands in the gutter with melted snow and ice water running around his heels, so much the better.

When you return to the stable, let the horse cover the last few rods at the top of his speed, and pull him up with a loud, triumphant "Wow!" Now don't miss a glorious opportunity to try the disposition of the animal. Unfasten all the attaching straps but one holdback, and start the horse out of the shafts. When you see the result, yell like a fiend. The strap that remains fastened will first make the shafts punch the horse in the stomach. Then pull all the harness off his back; if he does not kick, it is a sign that he is a good horse—there is no mustang in him. If it is winter and the horse much heated, either leave him in the stable unblanketed or put the blanket on at once and leave it on, wet, all night. A draught of cold air, from the opening above the manger to the door behind, blowing the whole length of his body, will help to season him If it is summer, slop his joints with cold water and give him a couple of swallows to drink—a "couple" means any number, from two to a hundred.

If the horse is tired and exhausted, do not forget to feed him at once. He might starve to death if you left him for an hour. A heavy feed of corn will please him greatly, and a generous allowance of corn meal will make him look nice and fat—probably before morning. A liberal dose of ginger, pepper, or "condition powders" will scare away any evil spirits that may be hovering about, and make everything all right.

If the horse is not dead by the next morning, you can fix him up at your leisure and thereafter conscientiously recommend him as "tough;" but should he be so unreasonable as to die during the night, you can console yourself with the reflection that it was not your fault—the animal was constitutionally weak.

Mailing Scientific Books Abroad.

It is hoped, now that the Universal Postal Congress is in session at Washington, that measures will be considered by it for the raising of the limit of weight upon a single book which may be sent through the mails to foreign countries. At present the limit of weight allowed by national agreement is 2 kilograms (about 4 pounds 6 ounces). Of course books of a popular nature usually come under this weight, but this rule practically shuts out a large number of valuable scientific books. The cost of producing scientific books is so great, and the sale of them is so limited and is attended with so many difficulties, that the whole world must be looked to for a market, so that it is a hardship to those who wish to purchase the same, to have them sent by express at large expense. As the law now stands the scientific books would appear to be discriminated against, but if the limit of weight were raised to 3 kilograms, most of them could be carried.

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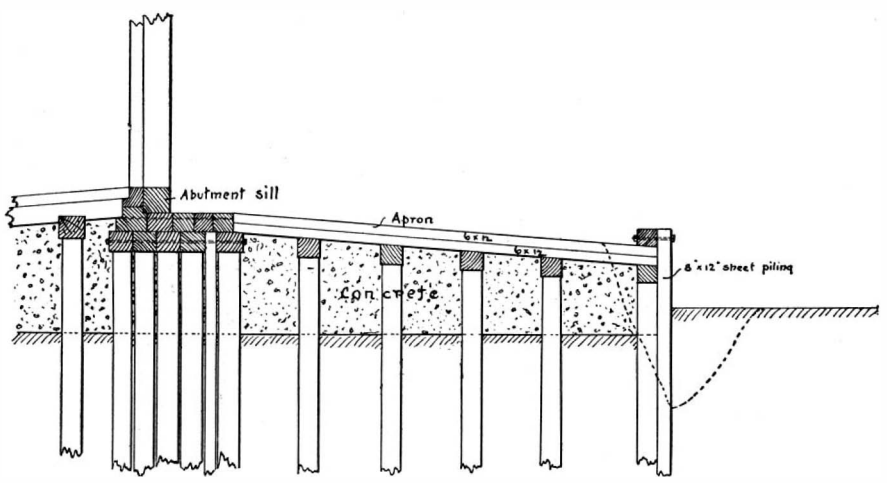
ORIGIN OF LEAK IN THE DRY DOCK, BROOKLYN NAVY YARD.

Recent developments in the investigation of the leaking dry dock at the Brooklyn Navy Yard have turned the attention of the engineers in an entirely new direction in their search for the exact location of the leak. There is now good reason to believe that, whatever seepage may be taking place from the old timber basin and buried cribs on the northern side of the dock, the bulk of the water is passing into the dock beneath the apron which extends from the outer sill into the entrance channel. This is rendered probable by the behavior of the water when the dock was pumped dry for examination, and several of the altar timbers on the north side were wrenched from their seating by the great hydraulic pressure and thrown into the dock. The sudden relief thus presented allowed all the water behind the altars to empty itself into the dock, and it was noticed that not only did the larger leaks on the north side stop running, but the streams of water were lowered on all sides of the dock at once, thus proving that the bulk of the water came from some particular quarter in the vicinity of the entrance.

A diver was sent down to examine the apron on the outside of the caisson gate, and he found that a hole had been torn open at the outer edge of the apron, exposing the underlying bed of concrete, and that a large hole had been formed in the bottom mud of the channel around the damaged structure.

By referring to the accompanying diagram it will be seen that the dock could not have been damaged in a more vital spot. The cut represents a sectional view of the entrance to the dock and shows the manner of finishing off the structure to a connection with the natural mud bottom of the entrance channel. The foundation of the apron is somewhat similar to that of the whole floor of the dock. It is carried on piles which are capped with 12 inch by 12 inch timbers. A solid bed of concrete from 3½ to 5 feet in thickness is worked in around the heads of the piles and finished off flush with the top of the caps. The flooring of the apron consists of two layers of 6 by 12 inch timbers laid to break joints, the outer edge of the floor being flush with the cap of the outer line of piles. A wall of 8 by 12 inch sheet piling is driven across the entrance in snug contact with the edge of the apron, each pile being bolted to a 12 by 12 stringer on top of the apron.



SECTIONAL VIEW OF APRON AT ENTRANCE TO DOCK NO. 3.

Dotted lines show damaged portion of apron and hole washed out in mud bottom.

The construction of the dock was carried on from the inshore end toward the channel, and the apron was built while there was yet a couple of hundred feet of solid ground between it and the Wallabout channel. The removal of this material was done by a floating steam dredge, and it is supposed that, in excavating the channel near the apron, the bucket caught the edge of the apron, tearing up the sheet piling and breaking away a portion of the concrete and the timber flooring. The water was now free to enter beneath the concrete floor and work its way along the sides of the dock. Under the great head of from 26 to 29 feet, the pressure upon the structure would be enormous, and would easily account for the bursting in of the walls on the occasion already referred to.

If, as is reasonably supposed, this is the cause of the leak, the dock can be rendered serviceable for a much smaller sum of money than has been named in the daily press, even if it should be necessary to go to the expense of building a temporary dam across the mouth of the entrance channel.

The New Supplement Catalogue.

The publishers of the SCIENTIFIC AMERICAN announce they have now ready for distribution an entirely new catalogue of valuable papers of the SCIENTIFIC AMERICAN SUPPLEMENT. There has been no catalogue of the SUPPLEMENT since 1891. Since that time so many important papers have been published that the need of a new catalogue was urgent. The present catalogue includes all of the most important papers from 1876 to date. Many subjects of the utmost importance have been published in the SUPPLEMENT which have not as yet any literature in book form. This renders the back numbers of the SUPPLEMENT particularly desirable to the technical library. The very latest discoveries, such as acetylene gas, argon, helium, Roentgen rays, etc., are fully treated. The catalogue now includes about 12,000 entries and consists of 48 pages.

As the SUPPLEMENTS are kept in print at a considerable expense, it is to be hoped our readers will not hesitate to purchase a series of SUPPLEMENTS when they desire information, as the cost is very low. The catalogue is sent free to anyone on request.

IT is reported that Dr. Nansen has purchased a yacht with auxiliary steam power for use in scientific researches during the summer. The yacht is of 37 tons measurement and will sail shortly for Norway.

Americans Who Toil.

A bulletin of the eleventh census just furnished shows that the total number of people engaged in occupations of all kinds in 1890 was 22,735,661—an increase of over 5,000,000 working people in a decade. This whole number of working people consists of those ten years old and over and makes up over 36 per cent of the entire population and almost 47 per cent of all persons ten years old and over. Of the whole number of working people, the females form 17·22 per cent.

Divided by classes, the working people of the country are as follows: Agriculture, fisheries and mining, 9,031,336; professional, 944,333; domestic and personal service, 4,360,577; trade and transportation, 326,122; manufacturing and mechanical industries, 5,091,293. The domestic and personal service includes hotelkeepers, soldiers, sailors, and marines, laborers, barbers, detectives, etc. The first named class is a 10-year gain of over 1,000,000, or of almost 3,000,000 for a score of years.

Considerably more than four-fifths of the illiterate male population of the country and over one-fourth of the illiterate female population are working. Over 59 per cent of the working men are married, over 37 per cent single, over 3 per cent widowed and one-quarter of 1 per cent divorced. Of all foreign whites at work here, 14 per cent of the males and 13 per cent of the females cannot speak English. Of this 8½ per cent employed in domestic and personal service, cannot speak English, and almost 5 per cent in the manufacturing and mechanical industries. Manufacturing and mechanics embrace the largest number of females who cannot speak English—over 4 per cent—with domestic service a close second.

In manufacturing and mechanics, the carpenters and joiners number 611,482 and make up the greatest element, with dressmakers and milliners following, with 499,690. There are a little over 1,000,000 bookkeepers, clerks and salesmen, 690,658 merchants and dealers, 5,281 agricultural laborers, 349,952 miners, and only a little over 60,000 fishermen and oystermen.

Professors and teachers aggregating 347,344 form the most numerous of the professional classes. Physicians and surgeons, with 104,805, come next, then lawyers, 89,630; clergymen, 86,203; government officials, 70,664; musicians, etc., 62,155; engineers and surveyors, 42,239; artists and art teachers, 22,496; journalists, 21,849; and actors, 9,728.

The Air of Bedrooms.

When there is too much water in the atmosphere, the person who breathes it is to a certain limited extent deprived of his due supply of oxygen, and an elementary beginning of suffocation is perceived in his chest, says the Hospital. Most middle-aged and all old persons have felt this; and all persons also who have weak hearts or impaired lungs. Now the air of bedrooms is exceedingly liable to be overcharged with watery vapor. The most obvious reasons for this are that many bedrooms are never warmed with fires, and that their windows are often left open all day until dusk, and sometimes even to the very hour of going to bed. Let us think of some of the consequences of going to bed in very damp air. A delicate or an aged person leaves a warm drawing room, say, at half past eleven, a drawing room in which there was a temperature of 68 degrees; he enters a cold, damp bedroom, say at a temperature of 38 degrees. The air in the drawing room was dry, perhaps a little too dry. The air in the bedroom is saturated with cold, watery vapor. The person we are thinking of, so soon as he enters the bedroom, chokes and gasps and coughs for half an hour at least, and sometimes brings on such an attack of asthma, or as he calls it "stuffiness" of the chest, that he can hardly breathe at all. He may even lose his night's sleep, and be ill for some days after such an exposure. Now, common sense says, "Make an effort to bring the atmosphere of the bedroom nearer in point both of dryness and warmth to the atmosphere of the drawing room; and then not only will a man feel as comfortable in the bedroom as in the drawing room, but even more comfortable. He will neither gasp, nor choke, nor cough, but will go to sleep with ease and comfort." Common sense teaches some people all this. But to those who have no special regard for common sense Science tells the same tale, and she speaks with a voice whose authority not even the most learned will question.—Hospital.

Livingstone's Grave at Old Chitambo.

Mr. Poulett Weatherley, an Englishman who has been for several years traveling in a leisurely manner in Central Africa, has recently explored Lake Bangweolo, and afterward visited Old Chitambo, where Livingstone's heart was buried. In a letter written to a friend at Zomba and published in the British Central Africa Gazette, Mr. Weatherley says: "I send you some leaves from a long way off—i. e., Livingstone's tree at Old Chitambo. After circumnavigating the lake I thought it a pity to leave the district without seeing Chitambo, so I trudged around the south of Bangweolo to the spot, crossing the Luapula about ten miles below Katapa, at a place called Kafufwe, where Glave crossed. From that point to the Mpundu tree I traveled his track. Neither the chief Chitambo nor the village of that name of Livingstone's day now exists. Chitambo, the late chief, lies on the south side of and under the same tree as Livingstone's heart, which is buried to the north of it. The village has been removed about ten miles to the west. The solitude of the spot is rather depressing, and I was rather glad to get away. The idea that the whole country to the south of the lake is nothing but a vast swamp is incorrect. There is certainly plenty of swamp, but also miles and miles of beautifully wooded country. Game there is but little of, as far as antelopes are concerned, the rinderpest having killed off nearly all. Elephants come out of the swamp during the rains, but when they come I hope to be elsewhere. I commence my return journey, via Mshota's, the day after to-morrow. I have taken photographs of the tree at Old Chitambo and one of the inscription. It is a thousand pities that some attempt is not made by people at home, who are interested in Livingstone and his work in Africa, to prevent the exact spot where he died from being hopelessly lost sight of, as it will be in a very few years. When the poor old Mpundu tree falls through fire and decay—it is now fast becoming a mere shell—after having kept guard so faithfully all these years—a quarter of a century now—there is nothing to replace it. Nothing could possibly be more appropriate than the simple rugged tree standing over the spot—no monument could be more inexpressibly solemn—but unfortunately it cannot last for ever. The Mpundu must go, and with it, unless prompt steps be taken, goes the knowledge of the site of Livingstone's last halting place. To me his grave in the Abbey is nothing to the Mpundu tree at Old Chitambo. The stream, on the right bank of which Livingstone died, is the Luwe."

The Uses of Fruit.

Of all the classes of Nature's edible productions, that of fruit is most pleasing to the senses. That fruit alone will not sustain life for a prolonged period is true, but that the organic salts and acids of fruit are necessary to the maintenance of perfect health is equally correct. Prof. A. R. Elliot (Dietetic and Hygienic Gazette, November) summarizes the uses of fruit as follows:

1. To furnish variety to the diet.
2. To relieve thirst and introduce water into the system.
3. To furnish nutriment.
4. To supply organic salts essential to proper nutrition.
5. To stimulate the kidneys, increase the flow of urine and lower its acidity.
6. To act as laxatives.
7. To stimulate and improve appetite and digestion.
8. To act as antiscorbutics.

Concerning the mode of preparation, ripe fruits as a rule do not need to be cooked, and are much more palatable and equally nutritious in the uncooked state. The proper time to eat fruit is either at the beginning of the meal or between meals, when they aid digestion and exert the greater laxative effect. Taken at the completion of a meal, they dilute the gastric juice and tend to embarrass digestion.

MR. H. WILDE, president of the Manchester Scientific and Literary Society, has given the Paris Academy of Sciences the sum of $27,000, to be used in giving an annual prize of $800, for a discovery or publication in physical science, the prize to be international. Mr. Wilde states that this gift is made as a return for the benefit which he has derived from French science.

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Correspondence.

American Locomotives.

To the Editor of the SCIENTIFIC AMERICAN:

The valuable series of articles which has appeared in the columns of the SUPPLEMENT is of very great interest to historians upon the English side of the Atlantic, and it also proves beyond all question the vast importance of the collection which was made at the Chicago exhibition of 1893.

In the course of my investigations I have ascertained that in the early days of American railroads, that is between 1828 and 1837, a large number of engines were sent out from England, as follows: By R. Stephenson & Company, 39 locomotives; by E. Bury & Company, 20 locomotives; by C. Tayleur & Company, 7 locomotives; by Rothwell & Company, 7 locomotive; total, 73 locomotives.

In addition to these, there is reason to believe that about fifteen others were sent, of which the full details cannot be traced in England, but of which some details were at the Chicago exhibition.

The articles in your columns have very clearly proved that the leading bogie or truck was used by Jervis in 1832, a year before the Davy Crockett was sent from England; they also prove that the link motion was first invented in America. In conclusion, allow me to express the hope that the interesting series of articles may be issued by you in a handy book form.

CLEMENT E. STRETTON.

Leicester, Eng., May 11.

[The articles referred to by Mr. Stretton, the well known English locomotive authority and author of the "Locomotive and its Development," are those which have been published in SUPPLEMENT, Nos. 1112, 1113, 1114, from the pen of Mr. Herbert T. Walker.]

Coal Tar for Roofs.

To the Editor of the SCIENTIFIC AMERICAN:

E. J. B., 7144, Notes and Queries, desires to know how to prepare coal tar for roofing paint. I have used it for roofing for years and find it very durable.

I buy second grade resin oil in preference to anything else to thin it, so that it can be easily worked.

This oil can be bought of the maker in this city at fifteen cents per gallon in barrels. Smaller quantities same price, if you find your own package. I hire any handy man, give him a stiff corn broom, and he will put it on a great deal faster and rub it in better than with a paint brush.

CHARLES R. WEBB.

Philadelphia.

National Debts of the World.

It is a well-known paradox that a country cannot be prosperous without a certain amount of national debt. This may be disputed, but it is certain that hardly a civilized nation is to be found to-day without the burden of national debt. The Handels-Zeitung, New York, compiled some interesting statistics on the subject, from which the Literary Digest quotes the following:

"The total national debt of the world is now $29,000,000,000, while in 1875 it was $23,750,000,000. France has the distinction of leading the world in this regard with a debt of $6,000,000,000, followed by Great Britain with $3,300,000,000. The third on the list is Austria-Hungary with $3,030,000,000, while Russia is fourth with $2,875,000,000 and Italy fifth with $2,530,000,000. Spain comes next, with $1,395,000,000, and the United States is seventh with $996,141,952. Germany has a debt of only $420,000,000.

"Spain owes comparatively the largest sum to foreigners, while in France the great bulk of the papers are in possession of the Frenchmen themselves. But nearly every other nation is indebted for enormous amounts to its own subjects. France takes the lead as a lending people on account of the good financial standing and the saving propensities of its people. The example of France seems to confirm the proposition that a national debt is a good thing for the prosperity of a people, for in that country the national debt and the general prosperity of the populace have steadily advanced in recent decades in equal proportions.

"The growth of national debts can be seen from the following table, in which the figures for twenty years ago are given in the first column, those for to-day in the second column:

France	$4,500,000,000	$6,000,000,000
England	3,900,000,000	3,300,000,000
Austria-Hungary	1,750,000,000	3,000,000,000
Russia	1,700,000,000	2,875,000,000
Italy	1,950,000,000	2,530,000,000
United States	2,220,000,000	996,141,952
Spain	1,375,000,000	1,395,000,000
Germany	1,000,000,000	420,000,000
Australasia	230,000,000	1,200,000,000
Turkey	675,000,000	900,000,000
Portugal	345,000,000	765,000,000
India	650,000,000	635,000,000
Brazil	475,000,000	590,000,000
Egypt	375,000,000	530,000,000

"Rather remarkable is the increase of debt in Australasia, especially over against the repeated statement of Great Britain that its loyal colonies enjoy a higher degree of prosperity than do those that have become independent. Japan and the Argentine Republic belong to the states that have in recent years been contracting debts on a large scale, the former now having $235,000,000 and the latter $370,000,000. Borrowers on a somewhat smaller scale are Belgium, with a debt of $445,000,000, Holland with $460,000,000, Canada with $255,000,000, an increase of $100,000,000 since 1875. The total debt of Great Britain, including the colonies, is $5,485,000,000, almost equal to the debt of France.

"One reason for the enormous increase of national debts is probably the fact that money is now much cheaper than it was twenty years ago. At present the total sum of interest to be paid on national debts is $1,115,000,000, while twenty years ago it was $1,000,000,000, although the total debt at that time was $5,000,000,000 less than it is at present. In 1875 Spain and Mexico paid as high as 15 and 18 per cent interest. Although the national debt of France is so enormous, yet it pays comparatively the smallest amount of interest money, namely $185,000,000, while Great Britain pays annually $125,000,000; Russia, $120,000,000; Italy, $117,000,000; Spain, $56,000,000; Austria-Hungary as much as $186,000,000. The latter country, accordingly, pays more interest than France, although the French debt is twice as large as that of the Austrian empire. It is interesting to note that each inhabitant of France must, on the average, pay each year $4.75 interest on the national debt; each Russian, $1.20; each Englishman, $3.15; each Austrian, $7.50; each Italian, $3.80; each Spaniard, $3.25; each American, 42 cents; and each German, 33 cents."

Recent Patent and Trade Mark Decisions.

Davis v. Chesapeake & P. Telegraph Company (U. S. C. C., Md.), 77 Fed., 895.

Implied License.—The patentee of a telephone device who sells out to a company of which he is a stockholder, a telephone exchange in which his device is used, thereby impliedly licenses the device in use at the time of sale, but no other such devices.

Electric Switch Pin.—The Watts patent, No. 223,969, for an electric switch pin, so constructed as to retain itself exactly in the switch board, as against any liability to be displaced by jars or jolts, has been held valid and construed.

New York Filter Manufacturing Company v. Niagara Falls Waterworks Company (U. S. C. C., N. Y.), 87 Fed., 900.

Infringement of Method of Filtration.—The Hyatt patent, No. 293,740, for a method of purifying water by introducing into it a coagulant simultaneous with its passage through the filter, thereby avoiding the settling basins of the prior art and making the process continuous, has been, on motion for preliminary injunction, construed and held infringed by a process in which the water is passed by a continuous flow through tanks before entering the filter, such tanks not performing the function of settling tanks.

Roemer v. Peddie (U. S. C. C. A., 3d Cir.), 78 Fed., 117.

Satchel Handles.—The Roemer patent, No. 314,724, for the combination of a strap and metal plates arranged on opposite sides, with the edges of the strap projecting beyond the plates and a covering secured to such edges to make satchel handles, has been limited to the precise device shown, and held not to be infringed by a handle having only one metal plate.

Green v. American Soda Fountain Company (U. S. C. C. A., 3d Cir.), 78 Fed., 119.

Soda Fountains.—The Witting patent, No. 414,272, has been held to be invalid as to the second claim for want of invention over the Adami and Lippincott apparatus. It was a mere matter of mechanical choice with Witting whether to make a lift or drop door to his case. He adopted the door as Adami had done and journaled the key as Lippincott had done, so that he produced no new result and no new and improved means for obtaining an old result.

Robbins v. Illinois Watch Company (U. S. C. C., Ill.), 78 Fed., 124.

Proof of Profits.—The profits of an infringer, where its books show none, cannot be established by proving the profits made by another manufacturer of the same kind of article and of the same grade, and if there is no other proof in the case, no decree for profits can be made. Where no profits have been made on sales, it is needless to attempt to apportion the profits arising from the part of the device manufactured that was covered by the patent. An infringer is under no obligation to the patent owner to so use the patented device or to so manage his infringing business as to make a profit.

Accident on the Third Rail Route.

By the dropping of the brake bar of a freight car of the new Third Rail branch of the N. Y., N. H. & H. RR., on May 15, the switchboard at the Berlin, Connecticut, power houses was burned out, causing a loss of one thousand dollars, delaying probably for a week the opening of the Third Rail route between New Britain and Hartford.

Science Notes.

It is said that the inhabitants of the Andaman Islands are the smallest race of people in the world. The average height of a full grown Andaman is less than four feet. The anthropological experts who visited them found that but few weighed over seventy-five pounds.

Matthew Carey Lea, who died on March 15, made many chemical researches, especially those relating to the chemistry of photography and to the action of light and other forms of energy upon silver salts. His most remarkable discovery was made in 1889, that silver was capable of existing in the three allotropic states.

Prince Luigi Amadeo of Savoy, Duke of Abbruzzi and nephew of King Humbert, is on his way to the United States, from whence he will go to Alaska and make an attempt to ascend Mt. St. Elias. The party will take a steamer at Tacoma for Yakutat Bay, which it is proposed to reach about June 25. The party by boat and sleigh will then cross the glaciers and mountains to the foot of Mt. St. Elias.

The two lenses for the Yerkes telescope in the Yerkes Observatory, at Williams Bay, Wis., were shipped on May 17, from the works of Professor Alvan G. Clark, at Cambridge, Mass. These disks are the largest ever made. A parlor car especially fitted up for the purpose was used in shipment. Guards were stationed at each door of the car and Professor Clark and his foreman took turns in watching the lenses.

M. Alphonse Berget has recently described a very interesting physical experiment for studying the expansion of liquids by means of photography. Two balances of equal sensibility with their planes of oscillations at right angles carry two weight thermometers; one containing the liquid under examination and the other mercury. A ray of light is deflected from two mirrors, one on each beam; this records on a sensitive plate a curve analogous to Lissajous' figures. This curve is the graphical representation of the expansion of the liquid.

The will of the late Professor Edward D. Cope, after making ample provision for his family, gives his collections for the benefit of science. His collections are given to the University of Pennsylvania, the Cincinnati Museum of Natural History, the American Museum of Natural History, the Philadelphia Academy of Natural Sciences. Certain of his collections are to be sold, and the available amount, estimated to be $40,000, is to be given to the Academy of Natural Sciences of Philadelphia, as an endowment for a professorship or curatorship of vertebrate paleontology.

At a recent meeting of the Paris Academy of Sciences M. Lacroix stated that recently in demolishing the old convent of the Place Royale, two old lead coffins were found bearing the date 1630. On opening one of the coffins the skeleton within was found to be partially wasted away and covered with crystals of hydrated bicalcic phosphate. The crystals were specially in evidence in the skull. They had evidently been produced by the action of the products of the decomposition of the body upon the calcium carbonate in the bones. The brain seems to have had an especial active part in this mineralization. The lead coffin had been very carefully sealed up, so that there could have been no action from the outside.

F. Mylius, F. Foerster, and G. Schoene, of the Physikalischtechnische Reichsanstalt, in Charlottenburg, Germany, have ascertained that ordinary steel contains iron carbide, Fe_3C. This compound contains 6·63 per cent of carbon and is similar to iron in appearance and in regard to magnetic properties; it differs from iron particularly by its great brittleness. So far the carbide has been found only in crystalline structure in manufactured steel, but it is known that some meteorites contain iron carbide in the form of crystals. Iron carbide is dissociated by heat, and reacts with iron at a bright red heat. Tempered steel contains no iron carbide, or only a very small amount of it.—Prometheus.

Some interesting experiments have recently been carried out by Professor W. Ritter on the oscillations of a tower in Zurich produced by the ringing of bells, says the Engineer. The tower, which is 39½ meters high, contains five bells, ranging in weight from 425 to 3430 kilo., and it is remarkable that the light bells produced greater oscillations of the tower than the heavy ones. The horizontal oscillations were elliptical in shape and variable in size, those produced by a bell of 705 kilo., which was swung fifty-three times per minute, being at a maximum of 3·6 mm. long and 2·4 mm. wide, the longest axis being in the direction of the movement of the bell. When the five bells were rung at once, the ellipse had a maximum major axis of 5·8 mm. and a minor axis of 4·4 mm. The bells were swung from forty-three to fifty-seven times per minute, while the tower oscillated quite uniformly 160 times per minute. It was shown that the oscillations were felt at any point in the tower below the bells, and that the amount of movement was proportional to the height above the ground. According to the principle of the conservation of center of gravity, the tower tends to move in the opposite direction to that of the bell, and this movement increases until the resistance of the masonry produces equilibrium with the impulsive forces.

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THE GREAT RAILWAY STATION AT BOMBAY, INDIA.

The city of Bombay has the grandest railway station in the world, and it is the finest modern architectural work in India. It is known as the Victoria Terminus. It is the terminus and executive offices of the great Indian Peninsula Railway. The architect was Mr. F. W. Stevens, M.I.C.E.

We present an engraving of the facade of this interesting building, which was brought prominently into notice during the exodus from the city caused by the bubonic plague. The principal or west front forms three sides of the square, the courtyard between the center building and the wings being 180 by 104 feet. The total length of the principal elevation is 1,500 feet. The building is Venetian Gothic, with Oriental modifications. The principal feature of the edifice is the large central octagonal dome of cut stone masonry, which gives a very fine effect and may be seen from any part of the city.

The figure crowning the apex of the dome is a stone statue of Progress. Each of the principal gables is surmounted by groups representing Engineering, Commerce, Agriculture, Science, Trade, while in front of the central façade is a lifesize statue of the Queen-Empress. The building was named on jubilee day in honor of the Empress of India. A large clock, with two illuminated dials ten and one-half feet in diameter, is placed in the south gable of the station roof; one dial in each gable, so that it may be seen from any point. In the central gable is another clock, with a dial eight and one-half feet in diameter, facing the street. The ornamental flat roofing is decorated in accordance with the rest of the building. The garden in the quadrangle forms one of the prettiest features of the building, and it is separated from the road by a handsome wrought railing ten feet in height. The piers and gates are in the center, the former supporting a lion and tiger and colossal figures representing Great Britain and India. The interior of the building is lavishly decorated, being fitted up in marble, granite and fine woods. Ample facilities are afforded for passengers while they are waiting for the trains Excellent restaurants are provided, as well as commodious offices for the officials and clerks of the railway. The ticket offices are in a hall eighty by seventy feet deep, the height of the hall being forty feet.

The sanitary arrangements have received the utmost attention and the restaurant is said to be the coolest in India. Altogether the station is a remarkable affair and reflects great credit upon those who are charged with the design and execution of this building. The execution of the work occupied ten years, and the estimated cost is about $17,000,000. Our engraving is from a photograph by Bourne & Shepherd, of Bombay.

THE GREAT RAILWAY STATION AT BOMBAY, INDIA.

Three Curious Plants.

The Los Angeles Herald states that three of the most dangerous of vegetative plants in the world are the "cannibal tree" of Australia, the "death" or "grapple plant" of South Africa, and the "vegetable python" of New Zealand.

The "cannibal tree" grows up in the shape of a huge pineapple, and attains a height of eleven feet. It has a series of broad, boardlike leaves, growing in a fringe at the apex, which forcibly brings to mind a gigantic Central America agave; and these boardlike leaves, from ten to twelve feet in the smaller specimens and from fifteen to twenty feet in the larger, hang to the ground and are easily strong enough to bear the weight of a man of 140 pounds or more. In the ancient times this tree was worshiped by the native savages under the name of the "devil tree," a part of the interesting ceremony being the sacrifice of one of their number to its all too-ready embrace. The victim to be sacrificed was driven up the leaves of the tree to the apex, and the instant the so-called "pistils" of the monster were touched the leaves would fly together like a trap, crushing the life out of the intruder. In this way the tree would hold its victim until every particle of flesh would disappear from his bones.

The "grapple plant" is a prostrate herb, growing in South Africa. Its flowers are purple and shaped like the English foxglove. Its fruit has formidable hooks, which, by clinging to any passer-by, is conveyed to situations where its seed may find suitable conditions for growth. Sir John Lubbock says it has been known to kill lions.

The "vegetable python," which is known to the naturalist as the clusia or fig, is the strangler of trees. The seeds of the clusia, being provided with a pulp and very pleasant to the tropical birds which feed thereon, are carried from tree to tree and deposited on the branches. Here germination begins. The leafy stem slowly rises, while the roots flow, as it were, down the trunk until the soil is reached. Here and there they branch, changing their course according to the direction of any obstructions met with. Meanwhile from these rootlets leafy branches have been developed, which, pushing themselves through the canopy above, get into the light, and enormously accelerate their growth. Now a metamorphosis takes place! For the hitherto soft aerial roots begin to harden and spread wider and wider, throwing out side branches, which flow into and amalgamate with each other until the whole tree trunk is bound in a series of irregular living hoops. From this time on it is a struggle of life and death between the forest giant and the entwining clusia. Like an athlete, the tree tries to expand and burst its fetters, causing the bark to bulge between every interlacing; but success and freedom are not for the captive tree, for the monster clusia has made its bands very numerous and wide. Not allowed expansion, the tree soon withers and dies, and the strangler is soon expanded into a great bush, almost as large as the mass of branches and foliage it has effaced. It is truly a tragedy in the world of vegetation.

Menthol Chloroform for Colds.

Wunsche (Therapeutische Monatshefte) says that menthol dissolved in chloroform is the most efficacious of all remedies. A solution of one or two parts of menthol in twenty parts of chloroform will not only arrest the progress of a cold in its initial stage, but it is also an excellent influenza prophylactic.

From four to six drops of the solution should be placed in the hollow of the hand, quickly rubbed between the hands, the two hands, tightly pressed together, placed before the face, and the remedy energetically inhaled alternately through the nose and mouth. It will be immediately noticed that the volatile parts of the solution thoroughly impregnate the mucous membranes of the nose, mouth and throat, and even penetrate deep down in the air passages. During the first two or three inhalations the sweetish chloroform vapor predominates. After, however, only menthol in attenuated condition is inhaled, odor and feeling remaining apparent for some time after the inhalation. As a rule, the first inhalation suffices to cure the severest tendency to sneezing, and often to arrest the progress of the cold altogether. Two further applications of the remedy in the course of the day suffice to suppress the attack completely. The first inhalation at first slightly increases the flow from the mucous membrane of the nose; afterward, however, this symptom diminishes quickly. Pains in the pharynx and larynx may be quickly eased and often entirely relieved by the remedy.—Med. Age.

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THE TONOGRAPH.

BY H. HOLBROOK CURTIS, M.D.

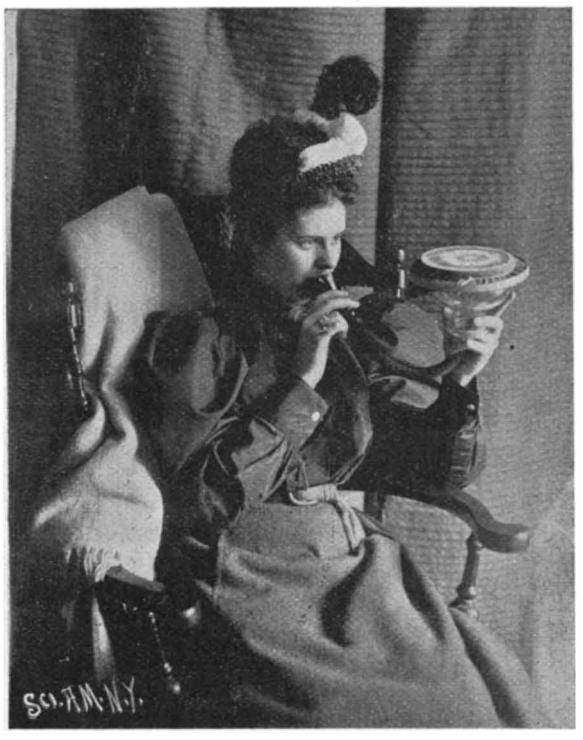
The illustrations published herewith show the figures which are produced by singing under a tense rubber membrane stretched over an inverted bell jar or curved tube made of metal. The notes of the chromatic scale have been reproduced from photographs taken from a disk of dental rubber dam stretched over a tin horn, the tonograph, curved to roughly represent the external meatus or outer tube leading to the ear drum.

Any one may produce pictures of the octave with its half quarter and fractional tones, for the membrane, when treated properly, becomes far more sensitive to the exact pitch than the human ear. The preparation of the rubber membrane is the only difficult part of making the apparatus, for the membrane must be very homogeneous and of equal tension. The simplest way to construct a disk of equal tension in all directions is to lay a 10 inch square of dental rubber dam on a smooth surface and make a few concentric circles with a pencil around a ten, twenty-five, fifty, and one dollar silver piece respectively. Next we take an 8 inch round embroidery stretcher and press the outside ring over the inner, putting the rubber on the frame as one does a piece of cloth. The membrane is next pulled in all directions to put it on the stretch, care being taken to keep the pencil circles from losing their shape and becoming elliptical. When the membrane is moderately stretched, the frame is overhanded with thread or glued. The diaphragm thus prepared may now be taken and pressed down over the funnel shaped end of the horn, the funnel being 5 or 6 inches in diameter, the horn about 3. By keeping the wooden frame equally distant from the edge of the horn and making forcible downward pressure we get a membrane as nearly homogeneous in tension as possible, and the nearness of the outer pencil circle to the rim will show just how tense it is When the membrane is quite like a banjo or drum head, we simply tie a cord around the rim of the horn and release the frame, which it is best to leave as part of the machine for future adjustment. The horn then appears as in the picture. If it is intended to take photographs from the membrane, it should then be treated with a fuchsin solution in alcohol and colored a deep red, which appears black in the photograph. The tonograph is then ready for use and only requires sufficient time to ripen for better results, as the longer the rubber is allowed to stand in tension the more homogeneous it becomes and the more perfect will be the geometrical figures which are produced. Rubbing in circular sweeps with the finger and drumming upon it daily increases its delicacy and activity.

For a given instrument the figures are exactly the same for a given tone; but the figures vary for different tensions of the membrane and for different diameters of the disk. The simplest substance to use and best to photograph is a mixture of table salt and fine emery, a few experiments being enough to show how much emery to add to make the cleanest figures. If the salt is damp, it must be placed in the oven and heated to expel the moisture. As much salt as can be put on a ten cent piece is then put in the center or sprinkled over the rubber membrane and a note sung in the open end of the instrument, when at once the beautiful figure appears which is the geometric expression of that pitch. It is more interesting to sing this note through a short tube or horn into the mouth of the instrument, for by this means we can hold the tonograph level, and more readily see the figures produced. In the same tonograph different voices make the same figures, but the overtones which model the nodal lines make more delicate tracery when sung in such a manner that their effect is not marred by bad production. The more beautiful a voice and the more perfectly employed with respect to overtone production or harmonic richness, the more delicate and beau-

PLATE I—TONE PHOTOGRAPHY.

MR. PLUNKETT GREENE SINGING INTO THE TONOGRAPH.



MISS PECK SINGING INTO THE TONOGRAPH.

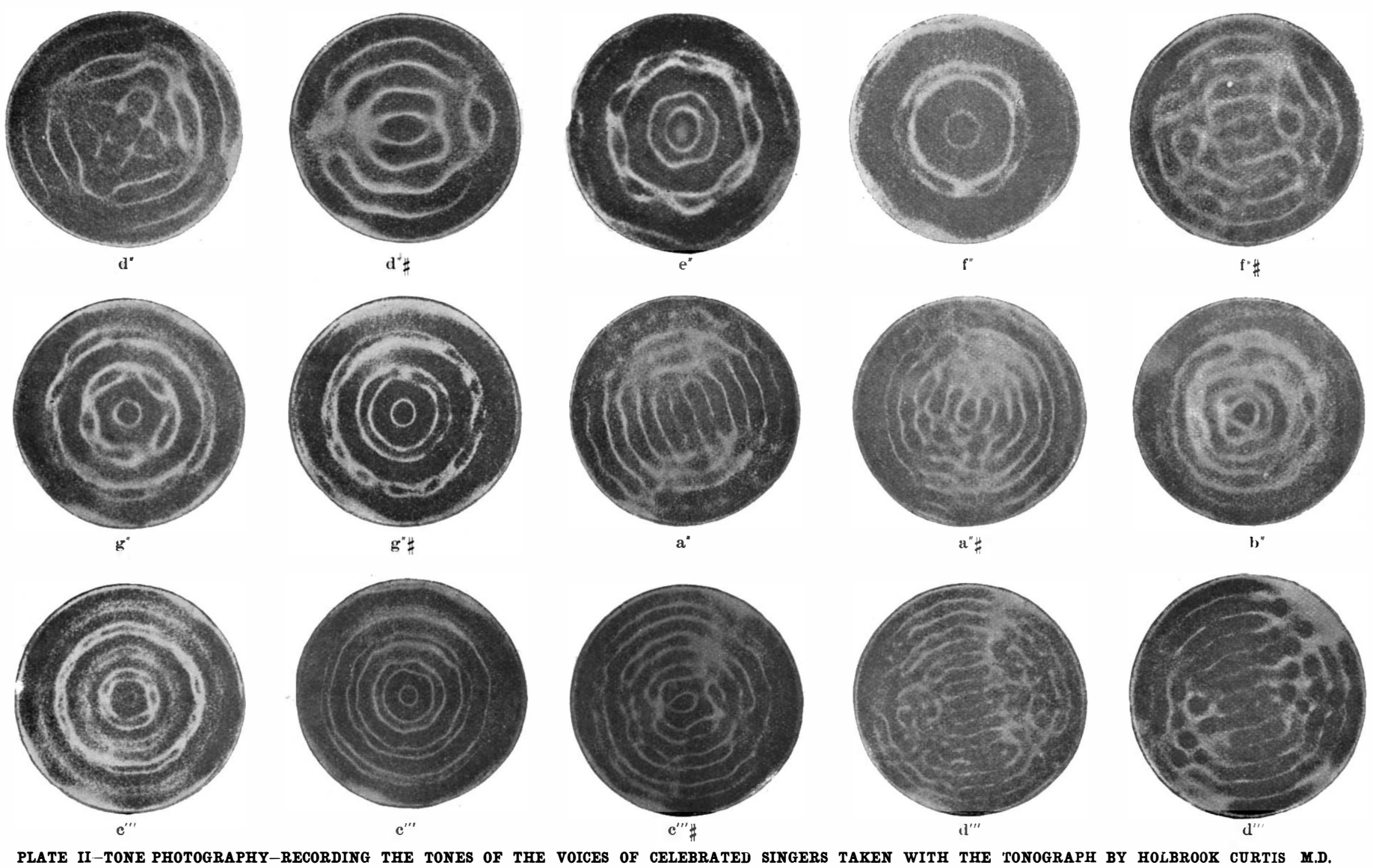


PLATE II—TONE PHOTOGRAPHY—RECORDING THE TONES OF THE VOICES OF CELEBRATED SINGERS TAKEN WITH THE TONOGRAPH BY HOLBROOK CURTIS M.D.

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tiful will be the picture. The picture made on this instrument is as exact as the tuning fork in determining pitch, and the pitch of any note may be at once ascertained by reference to the chart. It was my wish to reproduce the intricate picture of d‴ in altissimo on the tonograph, at the demonstration of the invention at the Academy of Medicine, in April, but for a moment it seemed impossible to get the pitch, as there was no fork or piano at hand. I however stated that, possessing natural pitch, I could strike c″ an octave below, and verify it by the picture produced on the chart, and then by taking the note above give the pitch to the boy soprano, Master Witter Peabody, who had kindly consented to sing the high notes for me. I did this, at once making the beautiful figure c″, when taking the next note and singing the octave above, Master Peabody immediately duplicated the most intricate d‴ in altissimo on the chart in its minutest detail. The plates of the chromatic scale are reproduced from the photographs without any retouching or disturbance of the salt. Two of these plates will be seen to be duplicates, c‴ and d‴, which are inserted to show the differences of the figures as sung by widely differing voices. Thus the second plate of c‴ was sung by a very celebrated light soprano, while the heavier lines in the first plate of c‴ (1,024 vibrations of the vocal cords per second) was sung by an equally celebrated prima donna, whose voice is of a more dramatic quality. The differences in timbre of the two voices are shown in such a way that we can see the strength of the overtones and the preponderance of certain harmonics which go to make up the quality of the respective tones—a truly visible musical analysis. The plates of d‴ were sung by a very high soprano and by the boy soprano mentioned above. In the second plate we see the quality of the male voice in the heavier lines and a wider plan of segmentation.

Plate III shows b′ and c″ on the staff, sung by a male voice, a well known tenor. There occur two or three figures between b′ and c″, as also between many of the notes, showing that there are notes in the geometric scale not taken into consideration by our musical notation on the piano, but which undoubtedly we recognize on the violin and cello. This subdivision of intervals undoubtedly lends the peculiar charm to these instruments.

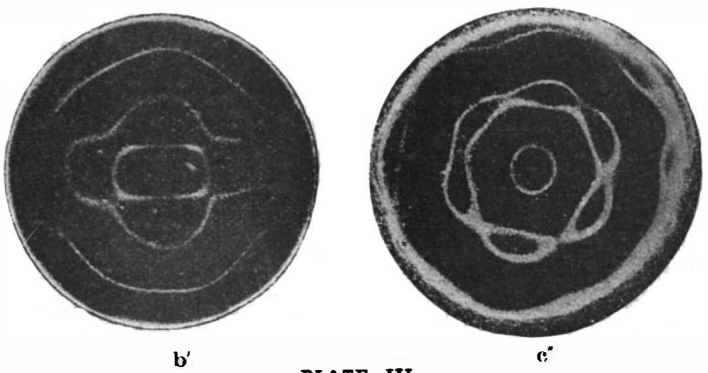
Plate IV shows the intermediates between c″ and d″. As we descend lower in the scale, the figures become simpler, Plate I showing a′, a′♯ and b′, as sung by a basso.

The above figures were sung by Madam Calvé, Jean de Reszke, Ben Davies, Plancon, Plunkett Greene, Ed. de Reszke, Miss Marie Donavin and Miss S. K. Peck. From a careful study of the results with such distinguished co-operation, I have arrived at the following conclusions:

A tone, to make a perfect geometric figure, must be sung well forward, with no forcing or tension, and with absence of shock or breathiness of tone. In other words, perfect production must be employed to make a harmonious figure, in the same way that it must be studied to make an agreeable impression upon our ear; and, from the same analogy, may we not reason that the little membrane of our ear drum may be divided up in the same exquisite arrangement of nodal lines by audible tones, and thus communicate to the brain, by means of the auditory nerve, the impression of agreeable quality in tone.

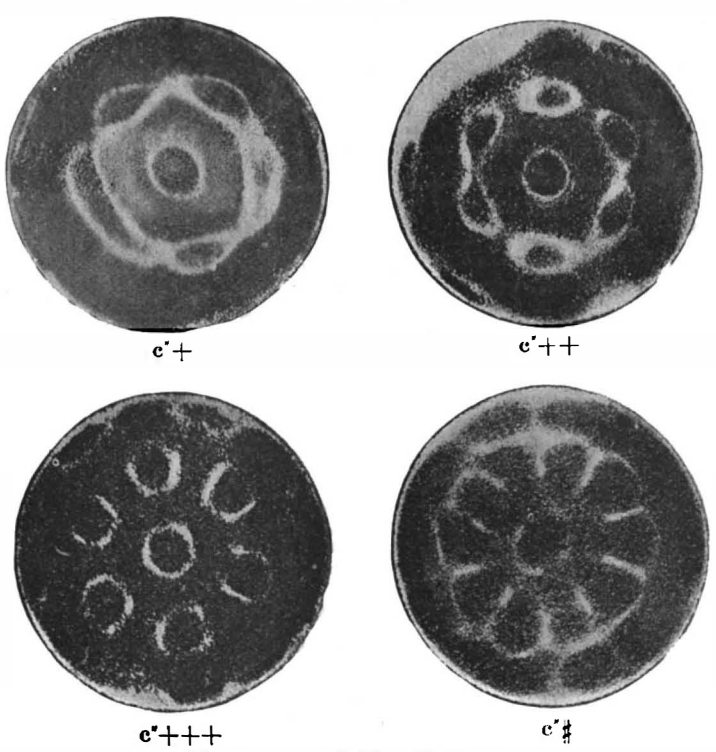
The pioneer in the study of shapes made by the voice in sand and pigments was Mrs. Watts Hughes, of London, and it was in attempting to imitate the shell and flower forms which she so beautifully described in the Century Magazine for May, 1891—pictures I have reproduced in my book on "Voice Building and Tone Placing," Appleton, 1896—that I conceived the idea of making a geometric musical scale, and the above mentioned figures have been the result of over a year's experiments with a vast amount of apparatus and many kinds of membrane. The simplest in the end has given the best results, and I describe my instrument in its easiest construction. The beautiful figures are of endless variety, and are as complicated as the sand forms on a Chladni plate or the scrolls made by the reflection of a ray of light from Wheatstone's luminous bead on a vibrating rod. My only claim to originality lies in the fact that I have utilized mixtures on a vibrating membrane to construct a geometric musical scale in figures, which are the same for equal tensions and diameters of membrane; and have further studied the relative specific gravities of the mixtures of salts and emery I employ to produce the best results for given thicknesses and tensions of the vibrating membrane—a subject I shall elaborate at another time.

The practical result I hope to attain is, to construct a tonograph which shall be so delicate that the pictures will record not only a mathematical expression for pitch, but for an analysis of tone quality as well.



b′ c‴

PLATE III.



c‴+ c‴++ c‴+++ c‴♯

PLATE IV—TONE PHOTOGRAPHY.

Odd Causes of Electrical Fires.

The quarterly report of the Electrical Bureau of the National Board of Fire Underwriters makes mention of the following odd causes of fire:

A plush curtain in a theater, on being hoisted, came in contact with a 32 candle power incandescent lamp. The common size is 16 candle power. The heat from the lamp ignited the curtain, but the fire was discovered, with no loss, except the curtain.

A stage hand was ordered to turn out an incandescent lamp, and not knowing how to do it, instead of turning the switch, he wrapped a damp towel around the bulb. Some time afterward the towel was discovered smouldering.

A portable incandescent lamp was allowed to remain lighted lying on a mattress. The heat from the lamp ignited the cloth and the excelsior of the mattress, and the fire spread through the basement and store.

An electric pressing iron was allowed to stand with the current turned on. The heated iron after a time set fire to the table, and the flames communicated to the surrounding combustible material.

A wagon loaded with gasoline collided with an electric car. The wagon was demolished and the oil flooded the street. The accident attracted the attention of the motorman of another car, who ran his car up to the scene. Seeing the oil running under his car, he turned on the current to get away. A spark from the wheel immediately ignited the gasoline fumes, and instantly the street was ablaze. Four people were injured, one seriously, and one horse was burned to death.

Fire occurred in a basement, owing to dripping water falling on an electrical measuring instrument, thereby short-circuiting it.

Sparks from arc lamps in a department store ignited cloaks on a table underneath.

An elevator motor was burned out, having been left running when the employes left the store, the motor brushes being badly adjusted.

A carpenter dropped a nut on the coils of a rheostat, short-circuiting them with an iron frame resting against a gas pipe. An arc was formed between the frame and the pipe; the latter was melted and the escaping gas ignited.

Rats gnawed the insulation from a wire which lay on a gas pipe; an arc was established between the wire and the gas pipe, setting fire to the gas.

ACCORDING to recent experiments of Prof. Trowbridge, says the Electrical World, with a 20,000 volt storage battery, it appears that the lowest voltage which will produce satisfactory Roentgen rays is about 100,000. He also found that electrostatic polarization is largely instrumental in the generation of X rays.

THE PRODUCTION OF GRAND OPERA.*

Grand opera, to be given adequately, requires a permanent home, and the Metropolitan Opera House, New York City, may be regarded as the home of grand opera in America, for here is given the longest season and here the great artistic triumphs are made. The Metropolitan Opera House has many interesting features; therefore we have selected it for the subject of the present article.

The building is built of yellow brick and occupies the entire block bounded by Broadway and Seventh Avenue, Thirty-ninth and Fortieth Streets. The auditorium is handsomely decorated and is capable of seating an enormous audience. We shall, however, confine our attention to that most interesting of places—the stage.

The stage of the Metropolitan Opera House is 101 feet wide and the depth is 84 feet. The height from the stage to the "gridiron" overhead, from which hang the scenes, is 90 feet. The first "fly gallery" is 36 feet above the stage, and the depth of the cellar is 28 feet. A reference to the plan will show that the stage is divided laterally into four sections, called "bridges," which run entirely across the stage. Each bridge is in turn divided into four parts, so that there are really sixteen working bridges. When it is desired to raise any part of the stage above the level, to represent broken ground or for any other purpose, a narrow trap door is lifted and a man at each end of the bridge raises it up to the desired height, as shown in our engraving. The bridges are counterweighted, so that it requires very little effort to raise them. It is possible to lift them to a height of 22 feet. The plan also shows the wing posts at the sides; these also slide up and down freely. They secure the "wings," or side scenes. No use is made of the cellar for raising the scenes, as it is found more satisfactory to operate the scene from above. The cellar is used for storage purposes and is divided into two mezzanine stories. When not in use the large drop scenes and the borders are rolled up and placed in racks. A section of the stage floor is arranged to lift up so as to permit of the long rolls of canvas being lowered into the racks. In the cellar is also machinery for working the various traps which will be noticed in the plan. These traps are very useful for suddenly elevating persons or properties to the level of the stage.

Going up several flights of stone stairs, the visitor arrives at the first "fly gallery." The "fly galleries" are narrow galleries which extend across each side of the stage. From the "fly galleries," which are most massive, the curtains, the "drop scenes" and the "borders" which form the sky are lowered. As the "drops" at the Metropolitan measure 45 × 70 feet, it will be seen it would be no small task to raise and lower them. From the "fly galleries" a very large number of these "drop scenes" are hung; more are hung up than are to be used for the opera. The canvas is hemmed so as to permit of a wooden pole or batten being thrust through it. This bar is secured to the ropes which raise the scenes or "drops" by means of clamps. At the very top of the building, underneath the roof, is what is called the "gridiron." It is an iron framework covering the entire top of the stage. It supports the pulleys over which the ropes run to raise the "drops," "borders" and "border lights." Each scene drop is supported by five ropes and most of the "borders" are also supported by an equal number. These ropes are attached at equal intervals along the length of the scene or border, and each rope passes over a pulley on the "gridiron" directly above the clamp which secures the wooden bar. The ropes are then assembled and pass down on the left of the stage to the first fly gallery. It will be noticed by reference to our engraving that all of the ropes are brought over to one side. This is called the working fly gallery. In raising or lowering a scene the five ropes are pulled at the same time and are secured to the "fly rail" by means of the belaying pins. The fly men climb up to the second and third fly galleries when heavy scenes are to be raised, and, catching hold of the ropes, descend to the first fly gallery on them. The curtain is raised and lowered by hand power by means of a winch, wire rope being used. An asbestos curtain is provided which may be instantly dropped to the level of the stage in case of fire.

We present an engraving of a corner of the stage showing the great switchboard and the prompter's desk, though, of course, in grand opera the prompter takes up a position under a hood directly in front of the conductor, just beyond the footlights. Just before the conclusion of the act the conductor rings an electric bell in the fly galleries as a warning and later gives the signal to drop it. The curtain calls from the audience

* Abridged from "Magic, Stage Illusions and Scientific Diversions," a new work which will be published in the autumn. Copyrighted, 1897, by Munn & Co.

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are responded to by the stage manager, who orders the raising and lowers the curtain by bells.

The little corner of the stage next the switchboard which we show in our engravings very much resembles the conning tower of a ship. Here are speaking tubes and electric bells which communicate with all parts of the house, and it is from here that the signals are given to work the traps or to produce the thunder.

The electric lighting of the Opera House is very interesting, though it does not have its own generating plant, taking the current directly from the street. The switchboard shown in our engravings is believed to be the finest in the world. From the switchboard every light in the house is controlled, both in front of and behind the curtain. Of course, the necessity of having all the lights upon the stage arranged so that the colors may be changed greatly complicates the switchboard. It is possible for the operator to move all of the rheostats at once if desired, thus producing a gradual brightening or dimming of the lights.

At the right will be noticed a number of small switches. These control the pilot lights which are fastened to the top of the switchboard. These pilot lights show the exact condition of every light both in the house and upon the stage, so that the electrician can see at a glance whether he has on the red, yellow, blue or white lights and the degree of brightness of any of them. The "drop scenes" and especially the "borders" are lighted by means of what are called "border lights," and which are shown in our engraving. The "border lights" run clear across the stage on a batten and they are suspended from the "gridiron" by means of wire ropes. There are 234 lights in each of the eight border lights. The lamps are arranged alternately in the four colors.

The cables for furnishing electricity to the border lights are attached at the level of the first "fly gallery." The "border lights" are maintained at a height just above the first fly gallery, and in case of any breakdown, gas is provided as a substitute. At the sides of the proscenium are what are called "side lights." Up in the first "fly gallery" are arc light projectors, which take the place of calcium lights. The wings are lighted by what are called "bunch lights"; they are supported by a standard. Gas and electricity may be obtained at any part of the stage. There is also an electric organ in the first "fly gallery," which may be played from any part of the stage.

The paint bridge is a wide platform at the level of the first "fly gallery," and it furnishes a means of communication between the two galleries. Canvas which is to be painted is run up and down the side of the paint bridge. The scenic artist thus has access to all parts of the canvas. On the paint bridge are long tables on which the materials of the scenic artist are kept.

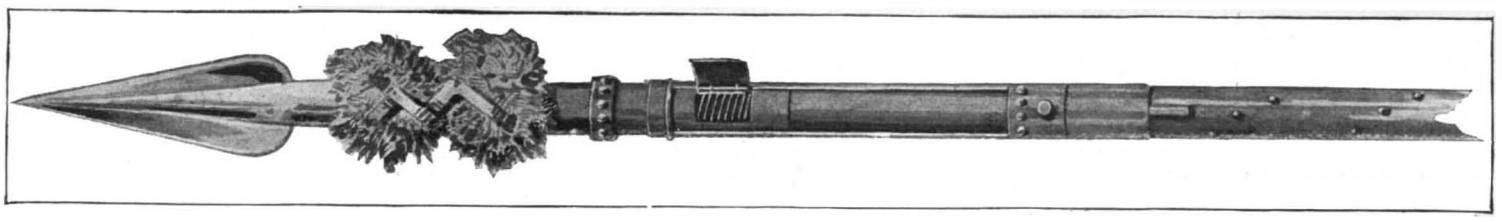
Having now briefly described a few of the interesting features of the stage, we come to the "properties," which are so necessary to produce the many effects which contribute so largely to the scenic effect. Space forbids us to do more than refer to a few of them. In the SCIENTIFIC AMERICAN of December 22, 1888, various other properties and effects are described.

In "Lohengrin," two entirely distinct trucks are used to carry the car or boat and the swan. On the front page engraving will be seen the one used in the first act, in which the swan and the boat wind their way through weedy meadows. Two men sit in the three-wheeled truck and propel it with their feet by shuffling; the first man steers the truck, the swan turning with it, while the rear man works the neck and wings by cords. The truck carries the boat and swan in a graceful curve through set scenes representing the bank of the Scheldt, the set scenes gradating in height. In the last act, when Lohengrin takes his departure, it is no longer necessary to have the swan and car take a sinuous course; so a four-wheeled truck is used, propelled by pushing. The swan is secured to a parallel and is held in place by the cords held by the stage hand. When the swan is to disappear, the lines are loosed and the bird drops behind the set scenes which mask the truck and the bird is withdrawn into the truck. As the swan disappears, the brother of Elsa is raised by a trap, so that he occupies exactly the same place as the swan. A clockwork bird now descends on a wire, and, taking the place of the swan, appears to carry off the car containing Lohengrin.

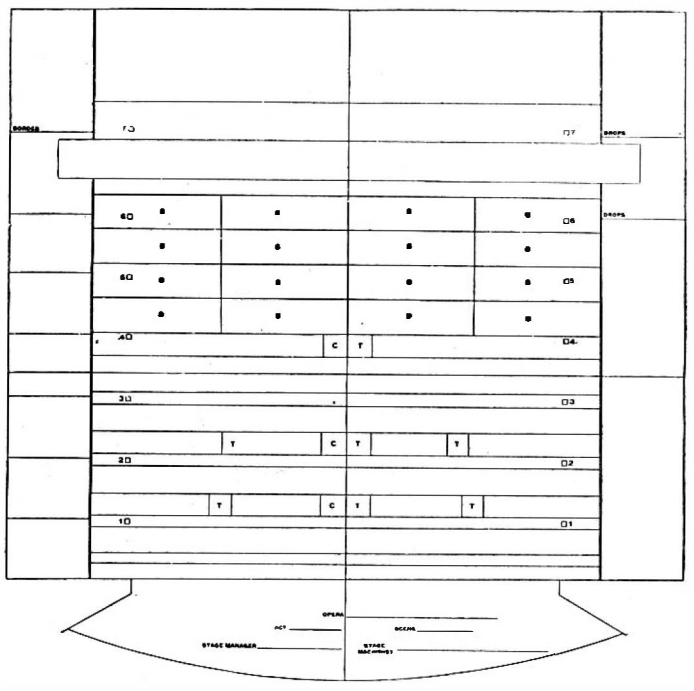
Siegfried's forge appears to be built of rocks, but really consists of an open framework covered with canvas. The top is masked in by painted work. Siegfried piles coal on the forge and blows the fire with a primitive leather bellows; he casts and forges the sword, the lighting of his face and the cave being very realistic. On the top of the forge are two incandescent lamps, and at the front three more of these lamps have red globes and are on two circuits. They are lighted and dimmed as required for the effect on the artist-smith's face. Gas is supplied by two pipes, one jet is kept going constantly, lighting the large rose burner which gives the effect of the flame when the gas is turned on to it. Steam furnishes the smoke and is turned on by a stage hand. A shelf underneath the forge permits of an exchange of swords. When the heated sword is thrown into the trough steam is admitted to it by a stage hand, producing a very natural effect.

Fafner the dragon, in "Siegfried," is one of the most interesting properties at the Metropolitan. It is the creation of Mr. Siedle, the property master, and is thirty feet long. The head is particularly terrible. It is made of papier maché and is painted in shades of green. The jaw, tongue and antennæ are all movable. The head is supported by the first man and is moved by the second man by means of a lever, the shoulders of the first man being the fulcrum. Each of the legs of the two men are incased in enormous boots which form the scaly, squat legs and hoofs of the monster. The body is of painted cloth and the tail consists of boards articulated with hinges. A hose runs through the tail and the body to the mouth, and carries the steam for the sulphurous breath of the monster; the steam is admitted by a stage hand in the wings. The eyes are provided with electric lights, the wires running through the tail. The dragon does not wholly withdraw from the cave, but stands in the mouth of it belching forth steam, the eyes gleaming fitfully.

The spear used by Wotan in "Siegfried" is made of two parts, the upper telescoping with the lower. In the lower part is a coiled spring which is compressed when the upper part is forced on the lower. The upper part is then secured by a catch. When Siegfried strikes the spear with his sword Wotan presses a button which releases the catch. The coiled spring now throws off the upper part of the spear, and in doing so strikes matches contained in the inside of the spear; the matches rub against sandpaper fastened to a small door which opens in the upper part of the spear. The matches set fire to a small quantity of guncotton, which lights flash paper concealed in the end of spear. This produces a remarkable effect, and is said to be superior to the electrical device formerly used. We are indebted for courtesies in the preparation of the present article to Mr. William Parry, stage manager of the Metropolitan Opera House, Mr. C. D. McGiehan, the stage machinist, Mr. Edward Siedle, the property master, and to Mr. Stewart, the electrician.



WOTAN'S SPEAR.

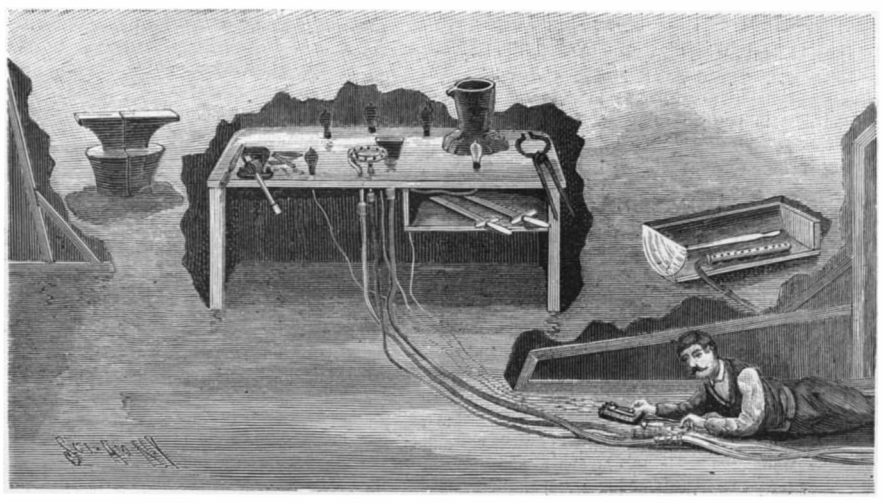


PLAN OF STAGE OF METROPOLITAN OPERA HOUSE.

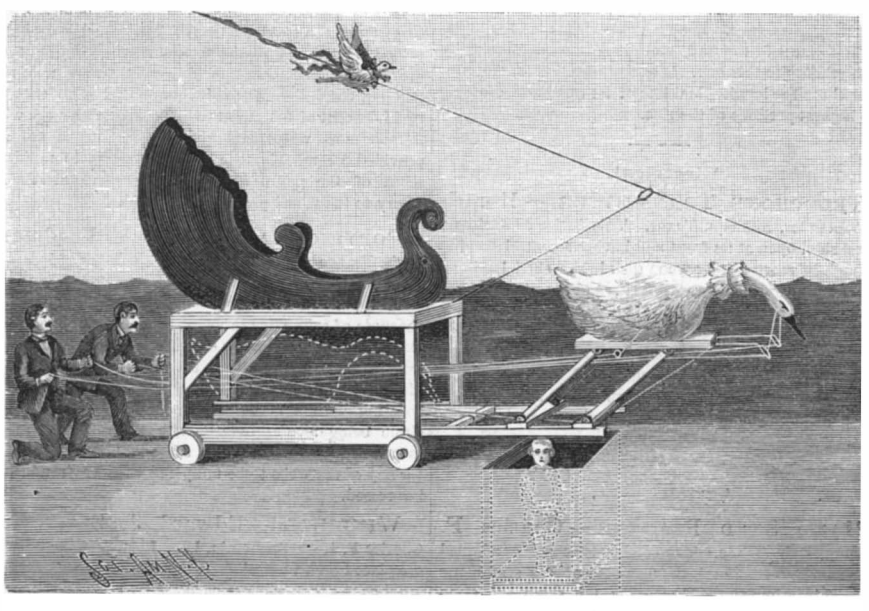
A Fast Run on the Burlington Road.

The Chicago, Burlington and Quincy Railway surpassed all its previous efforts in two directions on May 9, breaking the best previous running time over its tracks. A short time ago we chronicled the run from Denver to Chicago of a special train carrying a New York broker who was anxious to reach the bedside of his dying son. The special train which he chartered ran at the rate of a mile a minute. On May 9, the same car covered the distance from Mendota to Chicago, 79 miles, in 76 minutes, making an allowance of six minutes for two stops and slow running at La Grange, where track elevation is in progress and the track is supported by a temporary structure. Between Sandwich and Plano, a distance of 43 miles, the running time was three minutes. The 46 miles from Mendota to Aurora were covered in 43 minutes. The 69 miles from Mendota to La Grange took up 65 minutes of the total running time. To Western Avenue, a distance of 79 miles, the train ran at the rate of just one mile a minute.

THE American Bell Telephone Company make, it is stated, an average of 2,630,071 connections per day.



SIEGFRIED'S FORGE.



THE DISAPPEARING SWAN IN "LOHENGRIN."

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RECENTLY PATENTED INVENTIONS.

Engineering.

CENTER BLAST PIPE FURNACE.—Charles Johnson, Rutland, Vt. The center blast pipe of this furnace is formed in sections with tuyere openings between them, the pipe having at its top a perforated cap and a safety device for preventing the molten metal from passing through the tuyere openings and perforations. Complete combustion of the fuel is insured around and over the cap by forcing air and oxygen through the cap, and the molten metal will be allowed to run out of the furnace rather than pass into the center blast pipe, should the attendant fail to draw the metal at the proper time. The air also keeps the safety apparatus cool, and allows the operator to see into the cupola at all times.

HYDROCARBON BURNER.—Simeon A. Barrett, San Bernardino, Cal. This is a burner of simple and durable construction, more especially designed for burning crude oil of a low gravity without danger of forming an asphaltum or other residue, and thus avoiding a clogging of the burner. The oil feed pipe is surrounded by a steam supply pipe to cause the steam to spray the oil at the end of the oil supply pipe. The sprayed oil moves forward with the steam in the retort, so that the steam is superheated and the oil brought to the point of vaporizing, the mixture finally passing through the mouth of the burner to be ignited and burned in the firebox of the boiler.

Mechanical.

WINDING APPARATUS.—James S. Brown, Eureka, Cal. This invention relates to donkey engines and like machines used for logging and similar purposes. The object of the invention is to provide improved winch heads for winding apparatus, whereby wire ropes or cables may be used upon winches without forming kinks in the cable, whether the end or the middle of the middle of the cable is put upon the winch heads. The invention consists principally of a series of drums or spools mounted to rotate in unison. One of the spools receiving the rope or cable from the load, the line being then wound alternately on the other spools and in separate grooves thereon, by means of gears attached to the drum shafts and each meshing with the gear or gears adjacent, whereby a uniform peripheral speed is secured to each drum.

LANTERN.—Martin Killian, Central City, Col. The object of this invention is to construct a lantern which may be used in any way in which an ordinary lantern may be employed, and which may be also attached to a kettle for the purpose of enabling the contents of the same to be heated. The lantern is also provided with means so that it can be suspended from an overhead support or from an upright support. The lantern is also provided with devices by means of which it may be attached either to a receptacle or to a fixed object in a simple and economical manner.

VALVE.—Edouard Marchaut and Albert Dormoy, Bordeaux, France. The object of this invention is to provide a new and improved valve more especially designed for draining the water of condensation of a steam pipe or other device. In brief, it consists of a pipe coupling comprising two flanged members or sockets adapted to receive pipe sections, means for connecting said sockets, one of the sockets having an opening leading from its inner surface at a distance from the abutting surface of the sockets. An outlet pipe is inserted in the same opening and a valve is provided adapted to be seated on the end of the outlet pipe.

REVERSING MECHANISM.—Frank E. Gowen, Norrie, Col. This is an invention relating to sawmill sets and like machines, for which the inventor provides a new and improved working mechanism arranged to enable the operator to conveniently impart a turning motion in either direction to a shaft, wheel, or like device. By simply moving a lever the operator can impart the desired motion to the setting shaft, either in a forward or backward direction.

Bicycles, etc.

PNEUMATIC TIRE.—Henry Clay Williams, Trenton, N. J. The object of this invention is to provide an improved pneumatic tire for bicycles and other vehicles, and it is arranged to form a yielding flexible tread which insures easy riding, prevents slipping, and assists in the forward propulsion of the wheel. The tread is formed with a series of curved ribs parallel with each other, each rib being highest at the longitudinal center of the tire and being extended up each side of the tire and being regularly tapered, so as to have an arc-shaped edge which intercepts or runs into the cross sectional arc of the tire. Each rib extends across the longitudinal line of the tire and is disposed diagonally with relation to this line. The tire also has a rib running along the longitudinal line of its tread and crossing the highest portions of the ribs.

Electrical.

TELEPHONE TRANSMITTER.—Horace C. Alexander, Bonham, Texas. This device comprises a metal shell open at its front and having a central opening through its rear wall, a carbon disk in the shell having a central cell extended through it, and a series of cup-like cells in which are granulated electrodes, while a soft textile material between the diaphragm and carbon disk is cemented to the latter. The interposed soft material prevents rattling of the diaphragm, and by cementing it in place it cannot become crimped or displaced, and allow the escape of the granulated material in the cells.

Agricultural.

HAND SEED PLANTER.—Charles F. Merwin, Kyle, Texas. This planter is especially adapted for planting cotton seed, the dropping of the seed being effected by a forced feed, whereby the seeds are separated, irrespective of the lint which ordinarily causes them to cling together. The device has a lower wedge-shaped seed chamber, through which a plunger or slide is adapted to be pushed, forcing open a hinged plate and depositing the seed in the ground, the movement of the plunger also rotating a stirrer in an upper seed chamber adapted to carry a supply of seed, the feed being positive with each up and down movement of the plunger.

Miscellaneous.

CAN WASHING MACHINE.—F. A. Seuffert, the Dalles, Oregon. For thoroughly and automatically cleaning cans after they are filled with fish, preserves, etc., this machine is made with two oppositely arranged brushes with their adjacent runs rotating in opposite directions, between which the cans are passed. The machine is in use at the Dalles Fishery of Messrs. Seuffert Brothers Company, cleaning 100,000 cans in ten hours' work, without needing any special operator, the workmen simply placing the filled cans on a belt that runs along a table in front of them, the belt passing the cans through the brushes and depositing them clean on another table, ready for the crimper. The machine easily does the work for two or three filling machines and can toppers.

EXTENSION STEP.—Samuel R. Hamilton, Farmersville, Texas. This is a step for cars or other vehicles, and comprises a shaft pivoted beneath the lowermost of the fixed steps, L shaped brackets pivoted at the outer end of one arm to the shaft, a step fixed to the other arm and a spring attached thereto and adapted to swing the pivoted step back under the fixed steps, there being means for swinging the pivoted step forward and locking it in a horizontal position. The device is strong and of simple construction, and makes it possible to do away with boxes or other supports used to assist in getting up to the first or lower step.

WINDOW OR DOOR SCREEN.—John A. Stenen, Hillsborough, North Dakota. To allow flies, mosquitoes, etc., to escape from a room, and prevent their return, this inventor supplies the window or door screen with one or more transverse bars in which are openings, the outer portions of the openings, communicating with the outer air, being quite small, and their inner portions large. The outer openings may be partially or entirely closed by trap plates moved by an operating rod. As flies generally move upward on a screen, the design of the improvement is to accelerate their passage out, while limiting the possibilities of their entering.

KETTLE BAIL ATTACHMENT.—Fred A. Morris, Geneseo, N. Y. This inventor has devised a clamping attachment to be so applied to the bail and to the pot that when the bail is carried downward the attachment will be entirely out of the way and the top of the pot or kettle will be open to its full extent, admitting of the convenient application of a strainer or other device. The attachment is also designed to facilitate holding the bail firmly in upright position, and may be utilized to lock the cover partially or fully over the vessel, so that its liquid contents may be poured out and the solids retained, without danger of scalding or burning the hands.

MUSICAL INSTRUMENT.—Jay E. Walker, Lincoln, Kansas. A movable tuning bar, forming an attachment for stringed instruments of the banjo and guitar class, has been devised by this inventor, by means of which the pitch of the strings, after they have been tuned in the ordinary way, may be raised or lowered without tightening or loosening them. A transversely elongated nut slides longitudinally on the finger board, the nut being formed with two connected sections having limited independent movement, and the strings passing between the sections and being engaged by their contiguous faces.

NON-REFILLABLE BOTTLE.—Harry L. B. Lee, Brooklyn, N. Y. This invention provides a bottle and stopper which are useless after once being emptied, as the bottle may not be refilled. Permanently fixed in the bottle neck is a stopper sleeve with a partition at the bottom from which an outwardly opening valve is constructed as a flexible and collapsed tube, there being arranged in the sleeve above the valve inclined partitions with alternated openings, an air inlet tube passing through all of the partitions and beside the tube valve. The partitions prevent the insertion of any small instrument by which the valve might be manipulated or tampered with, and when the stopper is once fixed in place in the neck of the bottle it cannot be removed.

WIND WHEEL.—John W. Pippin, Rock Springs, Texas. This wheel is keyed on a horizontal shaft journaled in a rotatable skeleton frame supported by a skeleton tower, forming a light but strong support for the rotatable parts. The wheel body is supported, braced and attached to the shaft by light and inexpensive means, but in the most secure and rigid manner, the design of the invention being to secure a rapid descent of the pump rod and thus enable the wheel to raise more water in a given time. Means are also provided for relieving the shock incident to rapid descent of the pump rod, whereby severe strains and injury to the wheel proper are avoided.

COPYING MACHINE.—Jules Frydmane, Paris, France. This machine has a number of independent divisions which may be referred to when desired and impressed with a copy of any writing, as in copying accounts of sales slips in mercantile houses, each salesman or clerk then having one of the key plates referring exclusively to a definite web. A revolubly mounted disk carries a number of copying sheets, the disk coacting with a stamp and a moistener, and the machine being also provided with a numbering attachment. The construction is such that it is impossible for any of the webs to be tampered with or fraudulently impressed.

WINDMILL.—Edward J. Scovel and Charles F. Ross, Saunemin, Ill. In this mill the fans are placed on a vertical shaft in such form and distance apart as to secure as near as possible a screw or auger shape, and inclosed in a tubular casing, with a hood at the top, the air in operation flowing down through the casing as it acts on the fans. The great amount of surface presented by the several fans is designed to enable the mill to do good work in a light breeze.

NON-REFILLABLE BOTTLE.—William S. Hannaford, 312 North Marengo Avenue, Pasadena, Cal. This inventor has devised a bottle which cannot be opened and refilled without mutilating the bottle, the bottle to be used to prevent fraudulent imitations of genuine goods. In addition to using a cork, a flange surrounds the neck of the bottle and is connected thereto by a relatively weak section, a cap being inserted in the opening, and having internal automatic locking means by which its withdrawal is prevented. The cap cannot be released without breaking the flange.

BOTTLE WASHER.—Emil Kersten, Richmond, Va. This invention provides a machine for soaking and sterilizing bottles, and to facilitate thoroughly cleaning them both on the inside and on the outside. It comprises a tank adapted to receive a cleaning liquid, and a wheel mounted to revolve therein, the wheel having on its face supports standing in an inclined position, on which the bottles to be cleaned are placed. The tank is of such width as to prevent the bottles from sliding off the supports during the time the bottles travel through the liquid in the tank.

MUSIC LEAF TURNER.—Hiram Hammond and Robert Hammond, Lake George, N. Y. This is a device adapted for use in connection with a music stand or music rack on a piano, the music leaves first being attached to clamps or clips forming part of the device. The device is of simple and inexpensive construction and entirely independent of the instrument. Any leaf may be so readily and quickly turned as not to interfere materially with the rendition of music by the performer, and after all the leaves have been turned they may be simultaneously restored to their original position.

MUSIC BOX DAMPING DEVICE.—Henry Langfelder, Jersey City, N. J. For music boxes having reeds sounded by star wheels, this inventor has devised a spring damper adapted to engage the tongue and formed with a curved or bent portion, while a wheel operatively connected to the tongue sounding mechanism is arranged to move the spring damper, the wheel engaging the damper at the end of the bent portion opposite to that engaging the tongue, the bent portion curving around the wheel.

LEAD-LINED PIPE JOINT.—Douglas G. Brighton and Edwin M. Venning, London, Eng. According to this invention, a lining of lead is inserted or moulded in an iron or other pipe, the lead lining being continued, expanded, fitted or moulded into the joint of the exterior pipe or shell, so as to become, by fusion, pressure or otherwise, a part of the jointing material. The improvement is applicable to iron or other pipes with ordinary spigot and socket joints, but the inventors have devised a novel form of spigot and socket joint designed to facilitate the process of jointing.

DUST COLLECTING AND SEPARATING MACHINE.—John Shaw and Charles Scott, Woodburn, Oregon. To collect dust from any source and separate the air from it, discharging the dust in a stream where desired, these inventors employ a suction fan which discharges the dust-carrying air into a revolving hood, so that the air and dust travel in a revolving column, and the dust particles are thrown outward toward the inner surface of the hood and beyond the belt of air, whereby the dust and air are separated in consequence of the greater specific gravity of the dust particles. The casing for the fan is formed by the hood, which revolves with the fan.

BARN FRAME.—Robert S. McPheeters, Sand Creek, Minn. This is a frame designed to combine simplicity, economy and strength in the highest degree, and be also specially adapted for convenience and expedition in unloading hay, etc., and feeding stock. The basement has a central driveway with hatch; the frame has inclined rafters and connecting ridge pole, there being purlins and converging braces set on center posts, a track and carriage thereon beneath the ridge pole, with hay sling suspended from the carriage for elevating hay and conveying it to either end of the barn.

Designs.

MESSAGE BOX.—Augustus A. Weller, Port Jervis, N. Y. This patent is for a simple and inexpensive style of box in which messages may be placed for collection, the box having a transparent front section, enabling one to see when there is a message in the box. The inventor designs to utilize his invention in the establishment of a messenger service for towns and villages.

DISPLAY RACK.—Osborne E. Sully, Spencer, Iowa. A simple form of bent wire or rod device, formed and braced to give strength and lightness, is afforded by this invention to facilitate the exhibition of goods.

MEAT HOLDER.—Charles P. Loughridge, Nevada, Cal. This design comprises a combination rod support adapted to hold meat in various forms, holding the meat in position for convenient handling and examination.

PAPER LANTERN BLANK.—George T. Brown (of Brown & Williamson), Winston, N. C. This is a conveniently foldable blank having side sections with openings adapted to receive suitable transparent coverings or any desired inscriptions, the design being economical of material.

BICYCLE CROWN.—Hugh D McCarty, Providence, R. I. In this design top and bottom plates each have elliptical end openings and central round openings, tubular bosses connecting the plates. The edges of the plates project slightly beyond the outer surfaces of the bosses.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co. for 10 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS, ETC.

A NEW WORK ON MECHANICAL DRAWING. Easy lessons in mechanical drawing and machine design, arranged for self-instruction. By J. G. A. Meyer. To be issued in 24 quarto parts of about 32 pages each. First and second parts issued. New York: Arnold Publishing House. Price 50 cents each part.

The name of Mr. Meyer, formerly associate editor of the American Machinist, is a guarantee of the completeness of this undertaking. The numbers issued are excellent examples of line engraving of machine drawings with figured details. The text will furnish full details in elementary mechanics, graphic statics, strength of material and useful data for designing simple and compound steam engines, boilers and gearing. It is a valuable work for the student, as well as for workmen who are ambitious to get at the head in their handicraft.

MONETARY SYSTEMS OF THE WORLD. By Maurice L. Muhleman, Deputy Assistant Treasurer United States. New York. New York: Charles H. Nicoll. Pp. 239. Price $2.

At the present time, when the air is full of the sophisms and fallacies of those who have ways of mending our monetary system, out of hand as it were, it is a pleasure to note the appearance of such a book as this—a study of present currency systems and statistical information relative to the volume of the world's money. The author's knowledge is practical, and his position is such that he speaks as one with authority. The book also contains abstracts of various plans proposed for the solution of the currency problem in the United States.

ROCKS, ROCK WEATHERING, AND SOILS. By George P. Merrill, Curator of Geology in the United States National Museum and Professor of Geology in the Corcoran Scientific School. With numerous illustrations. New York: Macmillan & Company. Pp. 408. Price $4.

A book brimful of facts obtained by workers in divers fields is here presented by an author whose position has given him the best of opportunities to become acquainted with the results of all who have studied the physical properties of decayed rocks, as well as the origin, structure and mineral composition of rocks. The publications of the United States Geological Survey, the National Museum, and the Bulletins of the Geological Society of America have been drawn upon for materials for illustration, and many of the mechanical analyses have been made by the United States Department of Agriculture. In those instances, however, which are deemed of most importance, the author himself has not merely collected the materials, but made his own chemical analyses and microscopic determinations. The work forms a highly important addition to our practical knowledge of geology, looked at especially from the agriculturist's standpoint.

STEAM BOILERS. By Cecil H. Peabody and Edward F. Miller. With plates made to scale and numerous other illustrations. New York: John Wiley & Sons. Pp. 380. Price $4.

Two professors of the Massachusetts Institute of Technology here present a carefully executed work on the designing and making, managing and caring for boilers, the book being designed primarily for students in technical schools and colleges, but giving, in concise and convenient form, a great amount of matter with which the practical engineer should always keep himself familiar. The various types of boilers in common use are described, and the important questions of combustion, corrosion and incrustation are most intelligently treated. Grate areas and heating surfaces, and other proportions of furnaces and boilers, are described according to the best current practice, and the testing of materials, riveted joints, stays, etc., with the accessories of safety valves, gages, and traps, are given full consideration. A most interesting feature is found in the tables of details of vessels and machinery of the most notable Atlantic liners, representative vessels of the British navy, and the principal ships of our own new navy.

YEARBOOK OF THE UNITED STATES DEPARTMENT OF AGRICULTURE, 1895. Washington: Government Printing Office. 1896. Pp. 656.

We have here another valuable government report, got up in excellent style as regards practical features, and one which indicates considerable and well directed activity on the part of the agricultural department. It is a book which should be in the hands of every progressive farmer, the most varied topics of agriculture being included in its scope. We note especially an article by Roy Stone on co-operative road construction; a short but excellent contribution to the cause of good roads, which we all hope to see in the future. The exhibition of the department at Atlanta receives adequate treatment. The only thing missing, which we note on a short inspection, is a treatise on mushrooms; active interest in the subject is of extremely recent growth and it will doubtless be considered in the next report.

HANDBOOK OF STRUCTURAL FORMULÆ. For use of students, containing 180 structural and stereo-chemic formulæ. By Henry Leffmann. Philadelphia: P. Blakiston, Son & Co., 1012 Walnut Street. 1897. Pp. 57. Price $1.

While some exception may be taken to this book in its avoidance perhaps of certain formulæ and its arrangement without any accurate reference to systematic order, it is an excellent contribution to the study of chemistry and one which we would strongly recommend to students. It would have been interesting had the author given his authorities for some of the formulæ, notably those of asymmetric sulphurous and sulphuric acids. Chemistry should unquestionably be studied by broad formulæ, and the author deserves congratulation.

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The Norwich Line—New York to Worcester, Lowell, Gardner, Winchendon and Keene, N. H. From Pier 40, North River, 5:30 P. M., week days only.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Refrigerating Machine Company. Foot of East 138th Street, New York.

The best book for electricians and beginners in electricity is "Experimental Science," by Geo. M. Hopkins. By mail, $4. Munn & Co., publishers, 361 Broadway, N. Y.

The Temperly Transporter.

See illustration, front page of SCIENTIFIC AMERICAN, April 24. It is manufactured by the Lidgerwood Mfg. Co., 96 Liberty Street, New York. Write for particulars.

Wanted.—Mechanical engineer, understanding Spanish, and familiar with sugar machinery, to visit Spanish-American countries and solicit orders for manufacturer. Address with references, X. Y. Z., Buffalo, N. Y.

Will erect a hydraulic press brick machine for any parties or stock company desiring to manufacture brick and furnish the patent right to use same. Capacity 50,000 brick per day. For terms and particulars, address, T. A. Gordon, Shelbina, Mo. References given.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

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Minerals sent for examination should be distinctly marked or labeled.

(7163) A. S. M. writes: 1. I wish to lay underground, for a distance of about 50 feet, five battery wires (one of which to be connected with the carbon element and the other four with the zinc). Had thought of inclosing them in an iron pipe. Would you consider that advisable? A. We do not consider the use of an iron pipe necessary if the wires are perfectly insulated with a waterproof coating, such as gutta percha. 2. Would a quantity of metallic mercury equal to about a thimble ful be entirely volatilized if exposed to the atmosphere for a year? A. Mercury volatilizes with extreme slowness. We think that the quantity named would last for more than a year. 3. I wish to make a series of electrical contacts through mercury. Would there be any danger of the copper wire becoming foul with the scum sometimes seen on the mercury and so refusing to transmit the current? A. It would be advisable to use platinum terminals, and to keep a layer of alcohol on the mercury. But copper or steel terminals would work well for a great many makes and breaks. Possibly carbon would answer your purposes.

TO INVENTORS.

An experience of nearly fifty years, and the preparation of more than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. A synopsis of the patent laws of the United States and all foreign countries may be had on application, and persons contemplating the securing of patents, either at home or abroad, are invited to write to this office for prices, which are low, in accordance with the times and our extensive facilities for conducting the business. Address MUNN & CO., office SCIENTIFIC AMERICAN, 361 Broadway, New York.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

MAY 18, 1897,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Adjustable chair, H. S. Jordan	582,928
Adjustable platform, E. H. Fisher	582,815
Aerial flight, means for, L. P. Mouillard	582,757
Advertising and display apparatus, electric, J. L. Killmer	582,649
Advertising device, Fredericks & Arbeiter	582,633
Advertising medium, C. H. Gatchell	582,782
Alarm. See Speed indicating alarm.	
Alarm lock, S. C. Wolfe	582,711
Amalgamator, F. G. Jordan	582,745
Ant trap, W. B. Bond	582,977
Armature coils, machine for forming, G. A. Grisell	582,640
Automatic sprinkler, C. E. Buell	582,897
Axle, vehicle, D. A. Brown	582,806
Bag lock, H. Darling	582,850
Baling press, G. W. Murphy	582,940
Band cutter, J. H. Young	582,712
Bath cabinet, H. F. Gray	582,639
Bearing, ball, Price & Nagle	582,797
Bed and frame, spring, E. R. Weber	582,968
Bed bottom, D. M. Bone	582,895
Bicycle brake, M. E. Davis	582,984
Bicycle, convertible, L. T. Pates	582,678
Bicycle crank and crank axle, E. S. Leaycraft	582,750
Bicycle frame, A. Pinover	582,948
Bicycle handle bar, C. G. Dieterich	582,902
Bicycle hub, Henry & Tebow	582,861
Bicycle propelling mechanism, G. Beekman	582,974
Bicycle spring seat post, J. H. Layman	582,864
Bicycle starter, P. C. N. Pederson	582,764
Bicycles, speed gear for transmitting power in, F. Ecaubert	582,779
Blast furnace, F. H. Foote	582,817
Blind and awning, window, Gluck & Keach	582,783
Boiler. See Steam boiler.	
Boiler flue front, V. Klingler	582,747
Boiler flue front, steam, V. Klingler	582,746
Boiler furnace, J. F. De Navarro	582,760, 582,761
Boiler water tubes, machine for cleaning, Robeson & Bohne	582,953
Boilers, safety water column for steam, Elliott & Lawrie	582,624
Bolt. See Brake lever bolt.	
Books, etc., adjustable support for, D. E. Hunter	582,823
Boot or shoe strap, G. E. Shoop	582,961
Bottle filling machine, C. S. Dolley	582,623
Bottle, non-refillable, W. H. Gilman	583,011
Bottle stopper, F. A. Bickford	582,976
Bottling apparatus, beer, H. Wank	582,769
Box. See Match box.	
Box filling, capping, and labeling machine, Hoyte & Wood	582,988
Box making machine, J. H. D. Rehberger	582,876
Box nailing machine, P. D. Pike	582,947
Box, staying machine, J. Mohs	582,998
Brake. See Bicycle brake. Carriage brake. Fluid pressure brake.	
Brake handle, M. G. Hubbard, Jr	582,822
Brake lever bolt, N. Nelson	582,793
Bracket. See Lamp bracket.	
Brick, chrome, N. McConnell	582,942
Brush holder, S. H. Short	582,883
Burner. See Gas burner. Hydrocarbon burner.	
Butchering apparatus, N. Feidt	582,908
Button making machine, W. Nageborn	582,759
Cable grip, T. Obach	582,675
Caisson, E. S. Jarrett	582,744
Cake turner, griddle, W. L. Dodge	582,852
Calculating machine, E. B. Frew	582,634
Camera, photographic, E. R. Freeman	582,855
Camera, photographic, S. French	582,995
Can. See Milk can.	
Car coupling, J. D. Hoover	582,920
Car coupling, W. Kelso	582,929
Car fender, P. L. Benner	582,844
Car fender, G. P. Laubenstein	582,933
Car fender, F. J. List	582,934
Cars on steep grades, apparatus for braking and stopping street, E. Maginn	582,935
Card stop motion, woolen, P. H. Walsh	582,991
Carriage brake, baby, J. A. Crandall	582,899
Carriage return device, child's, I. Moe	582,997
Case. See Ticket case.	
Chain adjusting device, W. Pearson	582,945
Chair. See Adjustable chair.	
Churn and butter worker, combined, R. B. Disbrow	582,621
Cigarette casings, machine for making, P. Schaeffer	582,695
Cigarette machine, C. C. Satterwhite	583,002, 583,003
Cigarette machine, continuous, C. C. Satterwhite	583,001
Circuits, method of and apparatus for preventing formation of arcs when opening, T. Von Zweigbergk	582,772
Cistern or well cleaner, L. Leggett	582,653
Cleaner. See Cistern or well cleaner. Sucker rod cleaner.	
Clothes line, W. A. Johnson	582,927
Clutch, direct acting engine, J. D. Gray	582,819
Coin controlled apparatus, Force & Gundaker	582,730
Coin controlled apparatus, W. Reeves	582,685
Coke, etc., conveyor for, J. M. Dodge	582,903
Condenser and separator for steam exhausts, J. A. Dillon	582,813
Conveying apparatus, J. T. Cowley	582,809, 582,810
Cordage interlooping device, D. R. Malcolm	582,658
Corset, O. Gendron	582,818
Corset, D. Kops	582,748
Cotton opener, H. S. Houghton	582,922
Coupling. See Car coupling. Hose and nozzle coupling. Pipe coupling. Pole coupling. Thill coupling.	
Crane, overhead traveling, W. H. Morgan	582,662
Crane, self propelling steam, A. W. Robinson	582,766
Crate, folding egg, J. W. Bennett	582,613
Crate spring buffer, J. S. Hodge et al	582,919
Cue, W. A. Cunningham	583,009
Current meter, W. G. Price	582,874
Currycomb, A. Clapp	582,808
Cutter. See Band cutter. Stack cutter. Vegetable cutter.	
Dental articulator, F. Fourt	582,731
Dental mandrel, C. J. Peterson	582,796
Desk and seat, combined school, Smith & Hughes	582,885
Diazo compound, stable, A. Feer	582,853
Draughting board, J. H. W. Hawkins	582,786
Dress supporting and securing device, J. & W. H. Gelston	582,986
Dust collector, S. H. Wilson	582,967
Dye, trisazo, Schmidt & Ernst	582,958, 582,959
Dynamos or motors, brush holder for, S. H. Short	582,884
Electric controller, W. H. Morgan	582,663
Electric gate, automatic, J. M. Williams et al	582,889
Electric lock, H. Bezer	582,615
Electric switch, E. H. Wright	582,840
Electrical conduit, J. J. Groshans	582,910
Electrode, J. A. Deuther	582,721
Electrode, W. Majert	582,936
Electrolytic apparatus, A. E. Hunt	582,923
Elevating mechanism, screw, F. Stuempfle	582,963
Elevator, E. L. & G. Hall	582,987
End gate, wagon, Boulton & Mark	582,805
End gate, wagon, F. F. Emrich	582,814
Engine. See Gas engine. Steam engine.	
Engine reversing mechanism, steam, A. D. Ferguson	582,630
Envelop, B. B. Thomas	582,835
Eraser, blackboard, J. D. Barrie	582,612
Evaporator, rotary, F. & R. C. Sprague	583,014
Excavating machine, M. E. Pugh	582,683
Extractor. See Stump extractor.	
Eyeglass holder, W. A. Start	582,886
Eyelet blanks, device for cutting, J. Pickles	582,990
Fastener for gloves, shoes, etc., C. A. Pfenning	582,946
Fastening device, E. P. Manning	582,659
Feed trough, J. W. Farr	582,629
Feed water heater, T. M. Eynon	582,628
Fence, portable, C. F. Johnson	582,789
Fender. See Car fender.	
Fertilizer or seed distributer, S. L. Allen	582,610
Firearm sight, F. Merrem	582,660
Fire escape hoist, etc., F. Lyst	582,753
Fire extinguishing apparatus, C. E. Buell	582,896
Fishing hook, M. C. P. Parker	582,677
Flanging machine, I. Jones	582,863
Float or sinker securing device, O. T. Huebener	582,788
Flooring, J. W. Heaton	582,645
Fluid pressure brake, R. Fitzgerald	582,816
Fluorides, making, W. Mills	582,938
Fly trap, C. H. Elskamp	582,905
Folding machine, J. L. Firm	582,729
Form, coat, L. M. Marble	582,989
Freezer, J. T. Jordan	582,996
Furnace. See Blast furnace, Boiler furnace. Muffle furnace.	
Furnaces, purifier for blast, W. Kennedy	582,791
Galvanizing metal tubes, bars, etc., apparatus for, A. L. Murphy	582,667
Game counter, A. H. Wilson	582,771
Garment hook, J. J. Horan	582,742
Gas burner, C. H. English	582,626
Gas engine, J. A. Charter	582,620
Gas lighting apparatus for incandescent gas lights, automatic, A. Rammoser	582,875
Gas lighting device, automatic, Canellopoulos & Kratz-Boussac	582,619
Gas mantles, burner and appliance for supporting incandescent, J. De Brouwer	582,985
Gas manufacturing apparatus, F. Logan	582,655
Gas meter, coin freed, H. & C. Gamwell	582,781
Gate. See Electric gate. End gate.	
Gate, L. Lundquist	582,826
Gate, E. E. Smith	582,700
Generator. See Steam generator.	
Gilding films, roll for holding and applying, E. P. Browne	582,979
Gin saw sharpener, E. L. Chaffin	582,807
Glass articles, method of and apparatus for forming, J. Proeger	582,949
Glassware, mould for manufacturing, J. Proeger	582,950
Governor, marine engine, E. D. Bangs	582,715
Governing operation of driving eccentrics or crank shafts of pumping engines, mechanism for, W. Hartmann	582,642
Grain door, A. Lipschutz	582,865
Grain separator and cleaner, J. F. Hatfield	582,916
Graphophone, coin controlled, T. H. Macdonald	582,754
Grinding ores, etc., apparatus for, J. K. Clark	583,008
Grindstone tool rest, J. Nydegger	582,674
Gripping mechanism, S. S. Webber	582,708
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Hair cutting machine, C. P. Volland	583,005
Hand shield, E. B. Rebholz	582,765
Harvester, E. Pridmore	582,798
Harvester, corn, W. P. Lindsey	582,654
Hat holder, H. H. Freeman	582,912
Hay raking and loading machine, T. Rasmussen	582,951
Hay truck, O. E. Adolph	582,970
Headlight, dasher, W. W. Whitcomb	582,800
Heater. See Feed water heater. Tea or coffee heater.	

(Continued on page 350)

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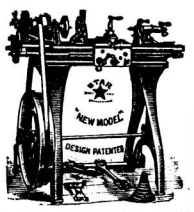

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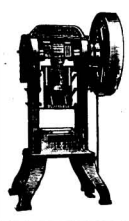

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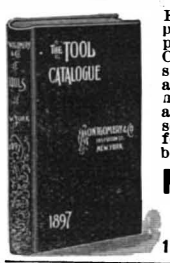

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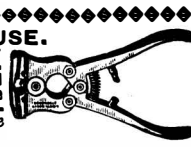

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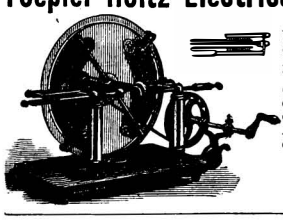

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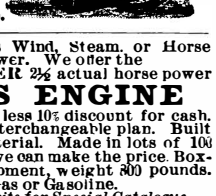

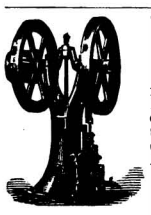

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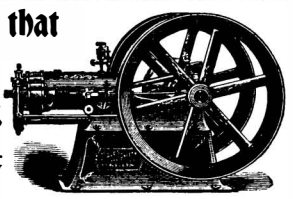

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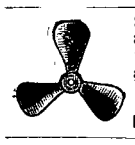

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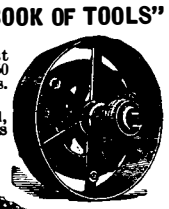

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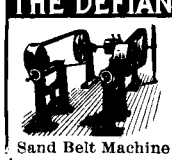
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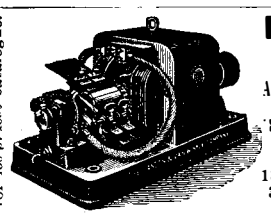

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(*Continued on page 351*)

PROPOSALS.

NEW EAST RIVER BRIDGE, { New York,
COMMISSIONERS' OFFICE, { May 13, 1897.

Proposals will be received by the Commissioners of the New East River Bridge at their office, at No. 49 Chambers street, New York City, at 2 o'clock in the afternoon of Wednesday, June 9, 1897, endorsed "Proposal for Construction of Foundations of Brooklyn Tower of new East River Bridge," for furnishing the materials for and constructing the foundations of the Brooklyn tower of the New East River Bridge, at or near the foot of South Sixth street in the City of Brooklyn, in accordance with the proposed form of contract and the plans and specifications therefor. All bids shall be inclosed in sealed envelopes, addressed to A. D. Baird, President of the Board of Commissioners of the New East River Bridge, and presented to him on that day and at that hour at said office, and such bids will be opened in public meeting by the Commissioners on that day at 2 o'clock.

Copies of the specifications and the general drawings of the work, with the proposed form of bid and contract, may be seen and further information will be given at the office of the Chief Engineer, No. 84 Broadway, Brooklyn.

Proposals will be made upon a form provided therefor, and only those proposals will be considered which are complete, in proper form, comply with the requirements herein stated, and are offered by parties of known reputation, experience and responsibility.

Each bidder will be required to deposit, with his proposal, in the office of the Commissioners, a certified check for $5,000, payable to the order of Richard Deeves, as Treasurer of the New East River Bridge Commissioners, as security for the execution by him of the contract if his bid is accepted.

The contractor will be required to give a bond in the penal sum of $350,000, in the form annexed to the proposed form of contract, with two approved sureties or an approved Surety Company, conditioned for the prompt and faithful performance of the contract, and its covenants and the work thereunder.

The Commissioners reserve the right to reject any and all of the proposals offered, and to accept any proposal offered.

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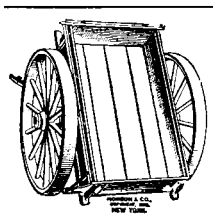

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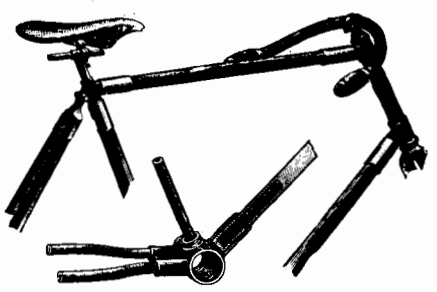

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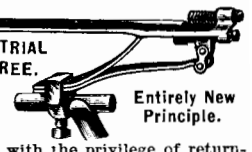

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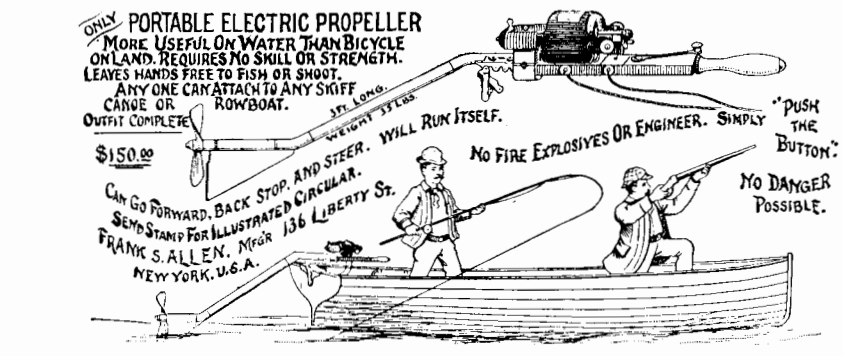
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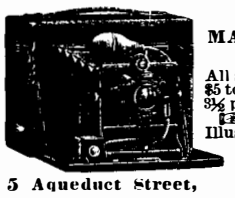

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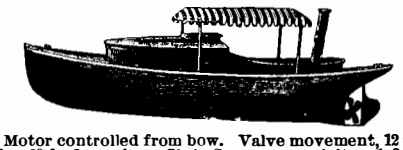
FLEER'S GURU-KOLA GUM,

for Brain Workers, gives Endurance, Steady Nerve, Good Digestion. Creates Vigor. *Ask your Dealer for it,* or Six Packages, by mail, 25 Cents.

Frank H. Fleer & Co., 105 Chestnut St., Philadelphia.

ALCO VAPOR LAUNCH



Motor controlled from bow. Valve movement, 12 to 1. 16 to 60 ft. Launches. Twin Screws a specialty. 1, 2, 3, 5, 7, 12, 14 and 20 h. p. No licensed engineer or pilot required. Speed and Safety guaranteed. No dangerous Naphtha or Gasoline used. No disagreeable vibration.

☞ *Send Ten Cents in Stamps for 1897 Catalogue.*

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THE BEST PEOPLE RIDE THE "POORMAN"

☞ *Write for Prices.*

J. E. POORMAN, Jr., 622 Race Street, Cincinnati, Ohio

CASTINGS fine iron, brass and bronze for all purposes, japanning, plating and finishing

W. G. Creamer & Co., 96 John St., New York

Family Ice Machine Ice, etc., in a few minutes, $10 and up. Filters, $1.25 and up. Cookers, $1. Seltzateurs to prepare one's self soda water, $4.50 and up. L. DERMIGNY, 126 W. 25th St., N. Y.

PIERCE ¾ H.P. VAPOR LAUNCH 2 GRADES A $125.00 B $118.00

ALSO ENGINES ONLY SAFE SIMPLE FULLY GUARANTEED STATIONARY ENG. to 25 H.P.
STAMP FOR CAT'L. PIERCE ENGINE CO.
17 North 17th Street, RACINE, WIS.

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Inside Page, each insertion - - 75 cents a line
Back Page, each insertion - - - - $1.00 a line

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The above are charges per agate line—about eight words per line. This notice shows the width of the line, and is set in agate type. Engravings may head advertisements at the same rate per agate line, by measurement, as the letter press. Advertisements must be received at Publication Office as early as Thursday morning to appear in the following week's issue.

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BEST ANTI-FRICTION METAL
MAGNOLIA METAL CO.
266 & 267 WEST STREET, NEW YORK CITY.
For one 3-cent stamp we will send any Engineer, mentioning this paper, a 15-inch Brass Edged Ruler.

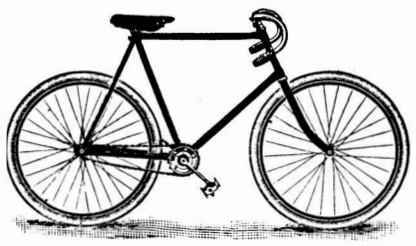
"Search-Light" Always Bright.

The Leader!

A lantern that does not jar or blow out.
Reflecting surfaces are always bright.
All riders say it is—THE BEST.
FOR SALE EVERYWHERE.
Bridgeport Brass Co.
Send for Catalog No. 196. BRIDGEPORT, CONN.

At ¼ Price Bicycles, Watches Guns, Buggies Harness, Sewing Machines Organs Pianos Safes, Tools Scales of all varieties and 1000 other articles Lists free CHICAGO SCALE Co., Chicago Ill.

Tribune Bicycle
Tested and True.



The Easiest Running Wheel in the World.
☞ *Send for Catalogue.*
THE BLACK MFG. CO., ERIE, PA.

The American Bell Telephone Company,

125 Milk Street,
Boston, Mass.

This Company owns Letters-Patent No. 463,569, granted to Emile Berliner November 17, 1891, for a combined Telegraph and Telephone, covering all forms of Microphone Transmitters or contact Telephones.

25 Years' Experience
The Largest Manufacturers in the World
Crescent Bicycles
The Oldest Makers in America
CATALOGUE FREE
Western Wheel Works, CHICAGO NEW YORK

WISE BUYERS BUY WHITE FLYERS
BARNES BICYCLES ARE THE FASHION PLATES FROM WHICH OTHERS ARE MODELED
A SOUVENIR CATALOGUE FREE
BARNES CYCLE COMPANY
SYRACUSE, N.Y.

Ride The Olive!

EVER READY AND RELIABLE

Strictly high grade. Features—attractive, practical and substantial. Agencies offered for unoccupied territory.
Mrs. A. E. Rinehart, the Champion Lady Century Rider of America, will ride an "Olive" during season of '97.

To Bicycle Riders

WE MAKE OUR TUBE of FIFTY CARBON STEEL

Because a Tube like this of our .50% CARBON STEEL

Is just as strong as a Tube like this of .25% CARBON STEEL

While WEIGHT FOR WEIGHT in a Bicycle our FIFTY CARBON Steel will last so long and TWENTY-FIVE CARBON Steel will last only so long . . . . .

NOTE THE FULL IMPORT OF THE PARALLEL LINES.

The comparison which they graphically make indicates the result of the prolonged investigations of the most practical experts of the world.
That the tests in our own laboratory corroborate these results is merely so much to its credit: that the same is true of actual trial on the road equally proves the trial to have been made in bicycles of correct design and construction. THE FACT REMAINS.
The margin of safety is greatly increased by the use of this tube. Every bicycle manufacturer should use it; every dealer should insist on having it; every rider should demand it.
Send for Catalogue. THE POPE TUBE CO., HARTFORD, CONN.

No. 4 BULLS-EYE .. $12.00.
For 4x5 Pictures.

As Simple as a Pocket Kodak.

Loads in daylight with our light-proof Film Cartridges. Fitted with achromatic lens, improved shutter and set of three stops. Handsome finish.
EASTMAN KODAK COMPANY,
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PARALLEL CLAMPS CH·BESLY&Co ALL ANGLES SIDES=U·S·A Chicago

H·W·JOHNS'
ASBESTOS STEAM PACKING
Boiler Coverings, Millboard, Roofing, Building Felt, Liquid Paints, etc.
DESCRIPTIVE PRICE LIST AND SAMPLES SENT FREE.
H. W. JOHNS M'F'G CO, 100 William St, New York.

Bristol's Patent Steel Belt Lacing.

The simplest, cheapest and most perfect Belt Fastening for all kinds of belting. *Samples sent free.*
The Bristol Co.
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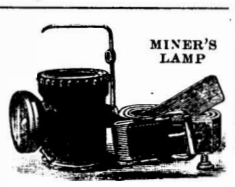
"Photograph Machines."

Having a demand for cheaper machines than we are manufacturing at $350, am in position to furnish Portable Photograph Machines for $75, taking pictures on large size *plate, 2¼ x 1¾ inches*, in 30 seconds. Do not require any dark room. Very simple in construction. Good for money makers and amateurs. Far superior to cameras, less trouble, better results, more rapid.
☞ *Terms Cash.* NATIONAL PHOTOGRAPH MACHINE CO., 85 Beaver St., New York.

BURNS ELECTRICITY.
"The Chloride"

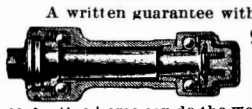


Most Powerful, Portable, Electric Lamp made for BICYCLES, Miners, Policemen, Carriages, Gas Companies, Oil Refineries, Boiler Inspectors. Burns 8 to 10 hours. Simple. Durable, Reliable.
☞ *Send for Circular and prices.*
THE ELECTRIC PORTABLE LAMP CO., Drawer B, ELMIRA, N. Y.

The Best Machines for Keeping Time
that it is possible to make are American Waltham Watches.
Get either the "*RIVERSIDE*" or "*ROYAL*" movement.
For sale by all retail jewelers.

"RIDE A MONARCH AND KEEP IN FRONT"
MONARCH CYCLE MFG CO CHICAGO NEW YORK LONDON

IMPERIAL BALL BEARING AXLE
A written guarantee with each set of axles.



97 PATTERN
8,000 sets in use.
Indorsed by the leading carriage builders.
Reduces friction 75 per cent. One horse can do the work of two. Mechanically perfect. Can be put on old or new work.
☞ *Write for our Illustrated Catalogue and Testimonials, which we send free on application.* Imperial Ball Bearing Axle Dept 184-190 Lake Street Chicago, Ill.

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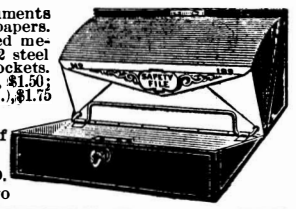
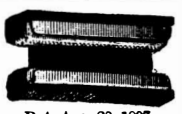


For important documents and all private papers. Handsome enameled metal case: lock and 2 steel keys; removable pockets. No. 10 (3x5¼x11 in.), $1.50; No. 20 (4½x5¼x11 in.), $1.75
Express paid.
Money refunded if not satisfactory.
A. C. Barler Mfg. Co.
101 Lake St, Chicago



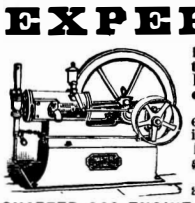
Pat. Apr. 20, 1897.

EVERYBODY who rides a Bicycle should have the
Rubber Pedal Attachment.
Changes Rat Trap to Rubber Pedals in ten seconds, without bolts or rivets. Sets of two mailed for 50c by ELASTIC TIP CO., 370 Atlantic Ave., Boston; 735 Market St., San Francisco; 115 Lake St., Chicago.

THOROUGH INSPECTIONS

AND INSURANCE AGAINST LOSS OR DAMAGE TO PROPERTY AND LOSS OF LIFE AND INJURY TO PERSONS CAUSED BY
STEAM BOILER EXPLOSIONS
J. M. ALLEN PRESIDENT W. B. FRANKLIN VICE PRESIDENT
J. B. PIERCE SECRETARY F. B. ALLEN 2D VICE PRESIDENT

EXPERIENCE!



Pay $ (X)—you have a "Charter"—the result of the Longest Experience in building Gasoline Engines in the U. S.
Pay less than (X)—you have experiment at your expense—inferiority—for We have the Foundation Gasoline Engine Patents.
☞ Catalogue, Testimonials and a Letter by addressing
CHARTER GAS ENGINE CO., Box 148, Sterling, Ill.

PRIESTMAN SAFETY OIL ENGINE
"A thoroughly successful commercial Engine using a Safe Oil."—Franklin Institute

No Extra Insurance, No Steam, No Gas. No Gasoline. Reliable, Safe, Economical, and Convenient. Chosen by Nine Governments. Used for nearly every purpose.
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